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The underrepresentation of women in STEM: a field experiment on the role of non-cognitive factors

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INTRODUCTION

Women constitute around half the world's population (World Bank Data 2019), but their contribution in shaping the present and the future is far below their potential. Science, Technology, Engineering and Mathematics (STEM) fields are key driver of today's economy, and high employability and incomes portray those fields as an attractive professional path. Notwithstanding, women only represent a small percentage of students and professionals in STEM. The challenges of economic growth and gender equality appear to be strictly intertwined. On one hand, growth is necessary to give women the opportunities they need; on the other hand, women's contribution to economic development is vital to achieve gender equality and prosperity. In this bidirectional relationship, equality in education is the first step to overcome the gender gap in STEM. However, in spite of significant progress in recent decades, schools and universities have proved time and again fertile ground for gender segregation.

The first chapter of this thesis will explore the close link between education, labour market and economic outcomes from a gender perspective, with particular attention to STEM fields. Equal opportunities in education are the gateway to women's empowerment, but often educational choices are gender-biased. Women choose academic tracks that lead to careers with lower pay and lower status and, ultimately, create labour market distortions, such as skill shortages and bottlenecks (i.e., occupations for which there is evidence of recruitment difficulties). Furthermore, horizontal and vertical segregation, the gender pay gap and the motherhood penalty further damage women's professional experience.

After having investigated the relevance of gender in the educational, professional and economical spheres, the second chapter focuses on what might cause such differences. Traditional explanations, such as discrimination and human capital accumulation (both as educational attainment and labour experience), have often failed to explain the observed gender gap in STEM, and more recent theories are shifting the attention on the role of non-cognitive factors. For this reason, as part of a broader research project, we designed a questionnaire to measure high school students' attitude to competition, risk and time preferences, self-efficacy, self-

control and self-esteem[1]. Totally, 29 high schools in the North-East of Italy were randomly selected to be included in the project, and over 6,500 students filled in the questionnaire. The objective of the questionnaire is twofold: on one hand, we intend to verify whether girls and boys differ with respect to non-cognitive skills and, on the other hand, we want to evaluate the influence of non-cognitive factors on educational outcomes and, ultimately, on the underrepresentation of women in STEM fields. Results of the analysis of the questionnaires will be illustrated in the third chapter of this thesis, where parallels with the existing literature will be drawn.

[1] I collaborated to the implementation of the project since I was awarded an internship grant for activities of research assistance by the Venice Centre in Economic and Risk Analytics for Public Policies (VERA Centre).

CHAPTER I

GENDER IN EDUCATION, LABOUR MARKET AND ECONOMIC OUTCOMES: FOCUS ON STEM

1.1 Gender gap in education

> *"Education is a catalyst for social change and a condition for the achievement of fundamental human rights. It increases cognitive and non-cognitive skills, improves productivity and provides individuals with a greater ability to further develop their knowledge and skills throughout their lives. It also makes women and men better equipped to secure steady, well-paid jobs and thus combat the risks of social exclusion. […] At the same time, educated citizens – both women and men – benefit entire societies. They make substantial contributions to the economy and contribute to the improved health, nutrition and education of their families." (EIGE 2016, p. 3)*

The above quotation emphasises how achieving equality in education contributes to fulfil human rights, among which stands gender equality. Women still encounter several obstacles along their path and would largely benefit from progress in education: they would be able to reach their academic and professional goals, hence actively contributing to the economy. In this chapter, the close link between education, labour market and economic outcomes will be investigated from a gender perspective, with particular attention to science, technology, engineering and mathematics (STEM).

The achievement of gender equality largely depends on a strong commitment to tackle gender prejudices and stereotypes throughout the education cycle, from primary school to lifelong learning. Studies confirm that gender segregation in the labour market is largely due to different educational choices made by students in schools and universities (Valentova, Smidova, and Katrňák 2007). Furthermore, equal opportunities for both men and women to enter tertiary education can contribute to a robust growth by raising the overall level of human capital and labour productivity (OECD 2019a).

Major institutions which operate at national and international level are therefore committed to find effective measures to address gender inequality. Among others, the 70th General Assembly of the United Nations (UN) adopted in 2015 the "2030 Agenda for Sustainable Development". The Agenda is described as "a plan of action for people, planet and prosperity" (UN 2015, 3) and it encompasses 17 Sustainable Development Goals and 169 targets, among which it is listed the *Goal 5: Achieve gender equality and empower all women and girls*.

When describing the global situation and the challenges the Agenda wishes to address, the document states that "the achievement of full human potential and of sustainable development is not possible if one half of humanity continues to be denied its full human rights and opportunities" (UN 2015, 8). The fifty percent of people the document refers to are women and girls who struggle to have the opportunity to become agents of change in society. Equal opportunities in education are the gateway to their empowerment, but often educational choices are gender-biased, even though they might appear gender-neutral.

In order to analyse the consequences of a gendered society, it would be helpful to understand what a gender stereotype represents. As explained by the European Institute for Gender Equality, "gender stereotyping occurs when a person is expected to enact a series of norms or behaviours based on their sex. Gender stereotypes refer to a cultural and socially constructed set of beliefs about what it means to be female or male" (EIGE 2016, 6). Some of these beliefs affect, among other things, the practices and curricula of schools in many countries, mainly because school staff are not trained to address gender-related topics. The learning environment is strongly influenced by social gender norms and it has an impact on the interaction between the teacher and students. In addition, gender bias is embedded in textbooks which overlook women's contributions to society, providing examples through strongly gendered lenses. This applies particularly when men and women are depicted in professional contexts and the result is an underrepresentation of women achievers in all disciplines, from science and mathematics to the arts and humanities. Nevertheless, the lack of training in gender mainstreaming and biased teaching materials are not the only reasons for the perpetuation of gender roles. The issue extends to socialisation patterns: peer pressure to conform to traditional gender roles has been identified as another

relevant factor, since peers are likely to react negatively when others do not replicate gender-typical behaviours (EIGE 2016; OECD 2012).

Attitudes are formed early in life and are influenced by traditional perceptions of gender roles. The persistent exposure of boys and girls to gender norms over school years inevitably leads to biased academic choices of students, which play an essential role in developing young adults' skills and, ultimately, their contribution to society (EIGE 2016). The importance of socio-cultural factors is further proven by the fact that employment expectations among 15 year-olds already reflect gender segregation, regardless of differences in economic context and education systems (OECD 2012).

Gender distribution across study fields is far from being homogeneous (OECD 2017). Despite female students having almost identical academic performances to males[2] (OECD 2012), and often exceeding the share of men among new university graduates (OECD 2018), they still choose to study subjects that lead to careers with lower pay and lower status (EIGE 2016). Students' expectations about labour market outcomes (e.g., wages and occupational segregation in a given occupation) only marginally influence the gender divide across disciplines (OECD 2012). Nonetheless, their choices impact their future employability and employment conditions, besides causing relevant distortions in the labour market. For instance, in spite of the progress made to narrow the gender gap in education attainment, women are still under-represented in science, technology, engineering and mathematics (STEM), which nowadays offer good career prospects (OECD 2017).

Prior to examining gender issues in STEM fields, it is worth glancing at gender-related trends in education more broadly. In this work, we will focus on the 36 Member Countries of the Organisation for Economic Co-operation and Development (OECD), an intergovernmental economic organisation founded in 1961 to stimulate economic progress and world trade. These countries are regarded as high-income economies[3] and with a high Human Development Index (HDI)[4]. In other words, they are considered developed countries and present similar characteristics with respect

[2] This general trend masks differences in individual countries. In Japan and the United Kingdom, for instance, the proportion of female graduates with top grades is around 10 to 15% lower than for males, whereas in Estonia, Italy, and the Netherlands it is true the opposite (OECD 2012).
[3] Definition: countries with a gross national income per capita of US$12,375 or more in 2019 (World Bank Data Team 2019).
[4] For further information, consult the website: http://hdr.undp.org/

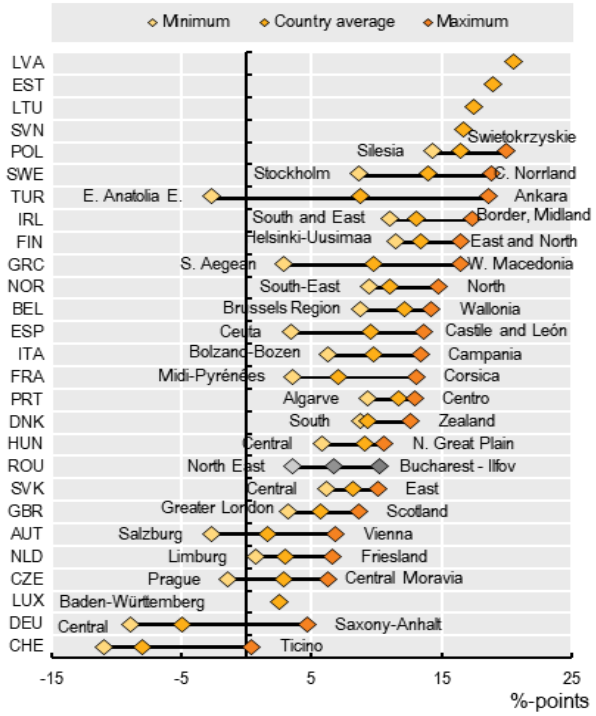
to macroeconomic aspects, but not necessarily in terms of gender gap. We are aware of the fact that developing and underdeveloped countries similarly struggle to reach gender equality. However, both the causes of gender differences in education and the consequences on labour market consistently differ from those of developed countries. Thus, given the incomparability, we decided to exclude them from our analysis.

Over the past decades, the expansion of tertiary education in OECD countries has benefited women more than men and the trend is expected to persist (OECD 2019a). In 2018, slightly more than a half of 25-34 years-old women (51%) had a tertiary degree, up from 40% in 2008. By contrast, 38% of 25-34 years-old men were tertiary-educated, an increase of 7 percentage points since 2008. The gender divide in education attainment will most likely continue to grow as women also outnumber men among new entrants to each tertiary level. On average in OECD countries, women represented in 2017 53% of new entrants at short-cycle tertiary level, 54% at bachelor's level, and 61% at master's long first degree level[5]. Moreover, in all countries the share of women was close to 50% or above at bachelor's and master's level (OECD 2019a).

When considering the data, it should be noted that not only gender differences in tertiary education attainment vary across OECD countries, but also across regions in a country (OECD 2018). Considering the regional dimension appears in some cases essential for a deeper comprehension of national estimates. A glance at Figure 1 reveals that women educational attainment often exceeds that of men. More specifically, in 2017 the proportion of women with university education attainment, i.e., women who obtained a degree in tertiary education, was on average higher than that of men (+10%) in 27 countries. This divergence was even greater in some regions: for instance, it reached 18% in Swietokrzyskie (Poland), Central Norrland (Sweden) and Ankara (Turkey). By contrast, in certain regions the share of men with tertiary education was significantly higher than that of women (this particularly applies to Switzerland and Germany).

[5] Short-cycle tertiary and master's long first degree programmes may not exist or are not prevalent in a number of educational systems. To ensure relevant cross-country comparisons, the analysis of the distribution of first-time entrants by gender and field of study at these levels of education only includes those countries where at least 10% of first-time tertiary entrants are enrolled in such programmes (OECD 2019a).

Figure 1. Difference between the % of women and men with tertiary education, 2017



Definition: tertiary education includes degrees from ISCED 5 to 8, according to the UNESCO framework.

***Source*: "OECD Regions and Cities at a Glance 2018" (OECD 2018)**

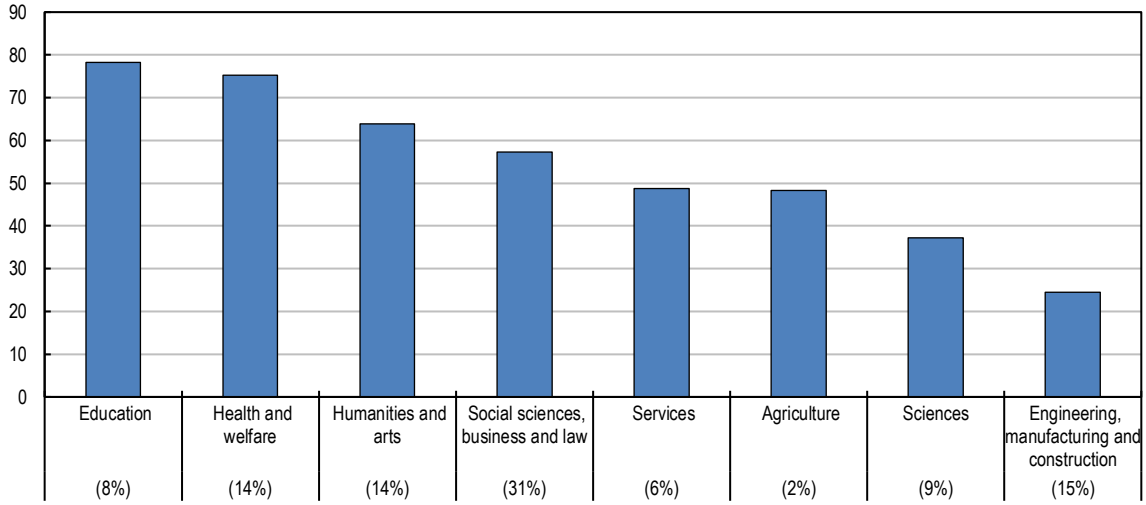
In spite of clear disparities, both at national and regional level, it should be acknowledged that over the last 15 years within-country gender differences in educational attainment have decreased, mainly as a consequence of the improvements occurred in the most lagging regions (OECD 2018).

1.1.1 Gender gap in STEM education

Despite major improvements in educational attainment, female and male students among developed countries choose their academic path differently, leading to gender stratification across fields of study (Figure 2). One of the most prominent and widespread trends is the underrepresentation of women in Science, Technology, Engineering and Mathematics (STEM). In 2014, the majority of women in OECD countries preferred education studies (78.17% of new entrants), followed by those who chose health and welfare (75.30%). At the other end of the spectrum, STEM degrees were the least pursued by women entering tertiary education: they accounted for only 37% of new students in sciences and even less in engineering, manufacturing and construction (24.44%) (OECD 2017). In particular, deconstructing the last percentage, the low proportion of women appears even

more striking, as one finds that only 18% of women entered engineering programmes. Computer science field of study presents a similar situation, with women constituting less than 20% of new entrants.

Figure 2. Proportion (%) of new students entering tertiary education who are female, by field of education, OECD average, 2014



Definition: First-time entrants into tertiary education are students who are enrolling in tertiary education for the first time, without previous education at any other tertiary level. They may enter tertiary education at different International Standard Classification of Education (ISCED) levels: short-cycle tertiary (ISCED 5), bachelor programmes (ISCED 6) or master's long first degree programmes (ISCED 7-LFD).
Note: The figures in parentheses under the x-axis labels indicate the share of all new entrants in each field of education.

***Source*: "The Under-Representation of Women in STEM Fields" in *The Pursuit of Gender Equality* (OECD 2017)**

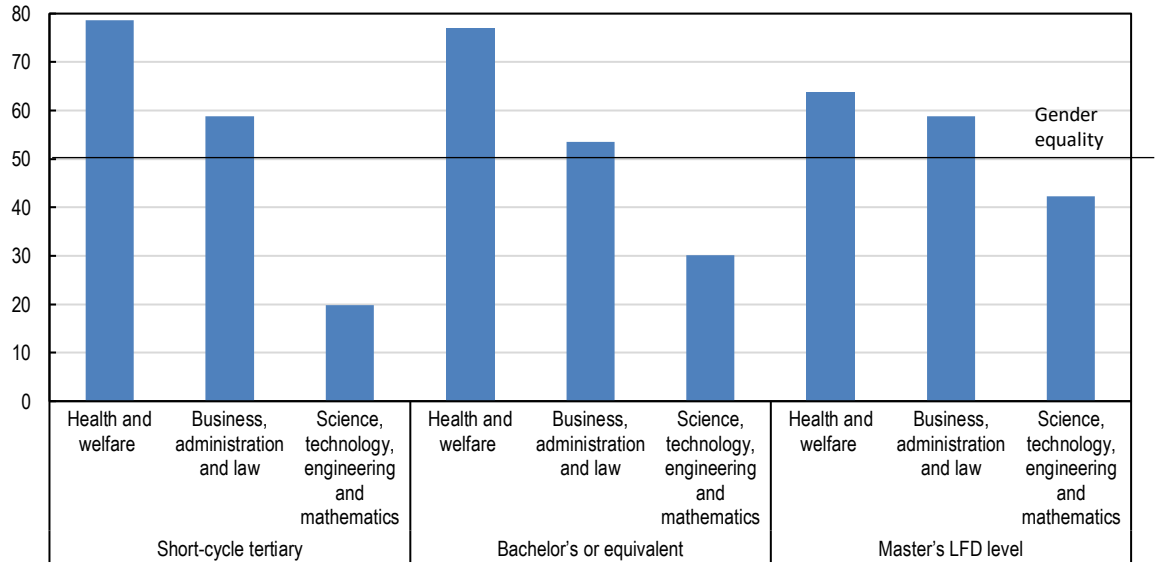
High employability and income potential portray STEM majors as a solid human capital investment for both women and men, as science-related competencies such as problem solving and quantitative analysis are considered essential in today's unpredictable and data-driven economy (OECD 2019a). Nevertheless, STEM fields are at the epicentre of gender segregation in education, limiting career diversification and often placing women in occupations that are less valued and remunerated (ILO 2018).

Broadening our analysis to the various tertiary educational levels and focusing on selected disciplines, it is possible to observe once more how STEM degrees are the least preferred option for women in higher education (Figure 3): in 2017, only 20% of new entrants to short-cycle tertiary programmes and 30% of new entrants to bachelor's programmes in STEM fields were women (OECD 2019a). Nonetheless, gender differences tended to disappear among new entrants into master's degrees

(42% of women) – although shares consistently varied across OECD countries, from 33% in Sweden to 58% in Hungary and Italy.

A similar but opposite trend can be observed among health and welfare fields. These disciplines were far more preferred by women and the gender gap decreased as we moved from the lowest tertiary educational level to the highest, i.e., from short-cycle programmes to master's degrees, approaching gender equality only at master's level.

Figure 3. Share of women (%) new entrants by level of education and field of study, 2017, OECD average



***Source*: "Education at a glance 2019: OECD indicators" (OECD 2019a)**

In conclusion, over the past decades women have achieved relevant results in educational attainment and the share of women who enter tertiary education has now overtaken that of men. However, females are underrepresented in some domains and overrepresented in others. Despite having made progress in several fields historically regarded as male domains (e.g., business, law and medicine), the persisting gender gap in STEM proves that further challenges must be faced.

1.2 STEM labour market: analysis of demand and supply

Tertiary education has proved to be a driver of growth (Chatterji 1998), and human capital composition affects countries' development. To this end, STEM skills assume even more relevance than others (Tsai, Hung, and Harriott 2010; Sequeira 2007). Education, however, does not directly translate into growth. It needs a bridge to connect to opportunities and that bridge is the labour market, which will be explored in this section.

Analysis conducted by the European Centre for the Development of Vocational Training (CEDEFOP) provides an overview on demand and supply in STEM labour market (European Parliament 2015). With regard to the demand, it reveals that employment of STEM professionals and associate professionals[6] in the European Union (EU) has increased since 2000 and demand is expected to grow until 2025. Specifically, the share of STEM professionals and associate professionals who were employed in the EU in 2013 was approximately 12 percentage points higher since the turn of the millennium. Additionally, it is estimated that demand in 2025 will have grown by 8% (compared to 2013), whilst the average growth forecast for all occupations is only 3%. The demand for STEM skills concerns both upper-secondary and tertiary graduates, on the ground that in 2015 almost half of STEM-related jobs required medium level qualifications, and forecasts for 2025 do not report significant variations. These qualifications are mostly obtained through initial upper-secondary level Vocational and Educational Training (VET)[7].

On the supply side, the situation is multi-faceted and relevant discrepancies across countries emerge. Over the period 2006-2012, the share of STEM university graduates on the total has slightly oscillated around one-fifth (from 22.3% to 22.8%). However, the average value depicts the situation only partially; in countries such as Sweden, Finland, Greece and Germany, for instance, three students out of ten obtained a STEM degree in 2012, whereas this rate was significantly lower (less

[6] Definition: STEM professional jobs include all those listed in the group ISCO-08 21 'Science and engineering professionals', whilst STEM associate professional jobs include the ISCO-08 31 'Science and engineering associate professionals' and ISCO-08 35 'Information and communication technicians', as defined by the International Labour Organization ('ISCO - International Standard Classification of Occupations' 2016).

[7] Definition: education and training which aims to equip people with knowledge, know-how, skills and/or competences required in particular occupations or more broadly on the labour market (European Centre for the Development of Vocational Training 2008).

than 15%) in the Netherlands and Luxembourg. All in all, the number of STEM university graduates increased by almost 40% in the years 2003-2012.

Conversely, the average amount of STEM VET graduates has experienced a downward trend in the EU between 2006 and 2012, with the only exception constituted by Cyprus. Among others, some countries witnessed a sharper decline: Lithuania, Bulgaria, Slovakia and Poland. Furthermore, the share of STEM VET graduates varied significantly across countries as well: they constituted more than 40% of upper-secondary VET graduates in Bulgaria, Estonia and Cyprus, compared to less than 20% in Belgium, Denmark and the Netherlands.

Notwithstanding the above and in spite of differences between the two educational paths, the common trends are high entry requirements, high dropout rates and the persistent underrepresentation of women among STEM graduates, which is even more pronounced in VET programmes – 13% of EU women graduate from STEM vocational education, whilst 32% of university graduates are women (General Secretariat of the Council 2017).

The dearth of female STEM graduates is a cause for concern as it hampers further women empowerment. Indeed, STEM-related competencies (e.g., problem solving and quantitative analysis) are regarded as fundamental in contemporary economy (OECD 2019a), and STEM graduates are among the most requested highly qualified job profiles and among the best-paid as well (OECD 2017).

1.2.1. Skills shortages, bottlenecks and unemployment

Important structural changes have occurred during the past decades, the rapid improvement in technology to mention but one. Consequently, required skills in the labour market have dramatically changed. At this point, we have established that STEM occupations are in high demand in the labour market and it may come as no surprise that the unemployment rate for STEM labour has been notably low since 2000 in EU countries. In 2013, for instance, the STEM unemployment rate was only 2%, whilst the total unemployment rate was 11% (European Parliament 2015). However small, the existence of an unemployment rate suggests that the relative supply of labour is low. A recent survey (ManpowerGroup 2018) conducted in 43 countries confirms that supply and demand in this sector are unbalanced.

Additionally, several STEM occupations are listed among the ten hardest vacancies to fill.

Focusing on European countries, a report (European Commission 2014) identified the top-20 bottleneck occupations in EU labour markets – i.e., those occupations for which there is evidence of recruitment difficulties, hence their vacancies are hard to fill[8]. The study reveals that the majority of the examined countries[9] have experienced difficulties in the recruitment of STEM workforce, especially for science and engineering professionals and ICT technicians (Table 1).

Table 1. STEM bottlenecks in European labour markets (2012-2013)

Occupational group	Rank (top-20 bottlenecks)	Number of countries affected
ISCO-08 21 'Science and engineering professionals'	2nd	21
ISCO-08 35 'Information and communication technicians'	3rd	20
ISCO-08 31 'Science and engineering associate professionals'	7th	14

***Source*: own elaboration based on "Mapping and Analysing Bottleneck Vacancies in EU Labour Markets. Overview report" (European Commission 2014)**

With regard to the most affected countries, these differ whether we consider one occupational group or another[10]. For instance, the top-5 bottlenecks of Sweden included all of the above occupational groups, whereas Denmark and Belgium suffered from labour supply shortages in ICT and science and engineering professionals. At the same time, Austria was the territory where most science and engineering associate professionals were sought after.

As for the main professions concerned, mechanical and electronics engineers were in high demand in the manufacturing sector, whilst the construction sector

[8] The indicators used to identify bottleneck occupations are the following: duration of vacancy filling, measured in terms of the time it takes an employer to fill a vacancy; past/existing bottleneck vacancies, measured by employers stating that they recently found vacancies in an occupation hard to fill (usually over the past year); expected bottleneck vacancies, measured by employers stating they expect vacancies in an occupation will be difficult to fill (usually over the next year). (European Commission 2014)

[9] The study covers EU-28 Member States, plus European Economic Area countries (Norway, Liechtenstein and Iceland).

[10] It should be noted that several countries with a high demand for labour in science and engineering, notably Germany, have not been able to produce a ranking.

was mainly searching for civil engineers; ultimately, ICT experienced a dearth of computer programmers and consultants.

Although bottlenecks characteristics are not homogeneous across countries and occupational groups, the main reason for shortages in STEM workforce is rather shared among countries and it concerns the lack of applicants with the required qualifications (i.e., degrees and diplomas) and sufficient experience. Particularly, the experience level has been reported as a major problem especially for ICT, with more than 50% bottleneck vacancies affected. This value is higher than in other high skill professions and it could be a consequence of the extremely fast technological progress in the ICT field, as knowledge becomes quickly outdated.

Turning to the unsatisfactory number of STEM graduates, several explanations have been proposed: some focus on the negative perceptions of STEM occupations (due to rapid technological evolution, which can rapidly make degrees obsolete), others on gender issues. As a matter of fact, gender-related aspects were relevant in all the three examined ISCO occupational groups[11]. The crux of the matter lies in gendered job images, the main deterrent to a balanced pool of available talents in these occupations. Other issues, like pay gap or other conditions not being gender-neutral, are rarely mentioned[12]. It appears clear that the full potential of the workforce is neither being harnessed nor reached to solve shortages in STEM labour market.

1.2.2 Horizontal and vertical gender segregation

Gender differences are deeply rooted in education systems and further reflected in the labour market. The term "gender segregation" can be distinguished in horizontal and vertical segregation – though often both forms occur together. As explained by the United Nations Educational, Scientific and Cultural Organization, "horizontal segregation refers to an uneven gender distribution between disciplines and between sectors of the economy (public and private), thus to concentration rates in certain occupational sectors or disciplines. Vertical segregation concerns

[11] Gender-related issues were reported as a reason of shortages in STEM for 59% of ISCO-21 bottlenecks (especially for mechanical engineers), for 64% for ISCO-14 and for 42% for ISCO-25 (mainly for software and web developers).

[12] No country reported lower wages for females to be an issue. This does not imply that wage differences do not exist.

the position of women and men within the hierarchies of science; such segregation is manifested as an uneven gender distribution over levels of seniority" (UNESCO 2007, 108).

Gender segregation has detrimental effects on society, contributing to the perpetuation of unequal gender power relations in the public and private spheres, which ultimately lead to discrimination. Although we acknowledge the existence of discrimination against men[13], this section will focus on the one experienced by women.

Women have made significant progress, now working as professionals in fields that used to be male-dominated. Notwithstanding, some occupations still report a dearth of females (e.g., construction workers, engineers or ICT professionals) (European Commission 2014). Improvements in women's labour market participation registered over the last decades have largely been due to women entering traditionally female jobs (General Secretariat of the Council 2017) and, as we previously stated, gendered job images are one of the reasons behind skills shortages today (European Commission 2014). Furthermore, women across the world prefer working in the public sector rather than in the private – a partial explanation for this being that public employment conditions are generally better regulated (UNESCO 2007).

Thus far, it has been found that in most OECD countries young women have at least the same probability as men to obtain a university degree, with no significant discrepancy in performance, regardless of the field of study (OECD 2012). Moreover, it has been assessed that females and males choose different paths and, as one can imagine, different choices in academic studies lead to distinct professional careers.

Although differences in occupational outcomes are largely attributable to educational choices, horizontal segregation is further reinforced in the transition from higher education to employment. The fact that more women are obtaining STEM degrees overall does not necessarily translate into a higher participation to STEM labour market (UNESCO 2007), since in many cases women who enrol in a STEM field often switch to a non-STEM field – a phenomenon commonly pictured as

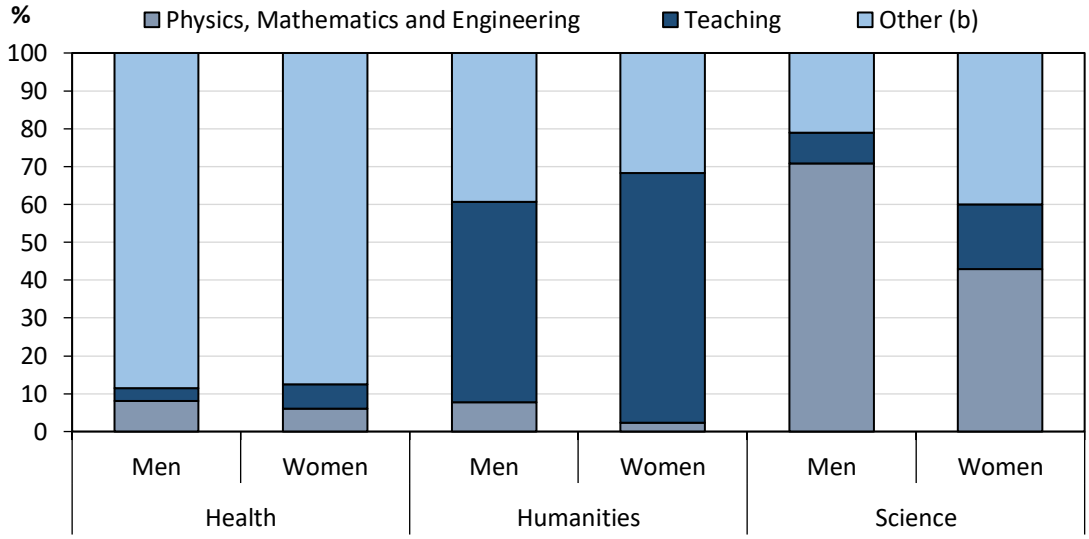
[13] For instance, men find it difficult to work in pre-primary education, nursing, personal care and domestic work, owing to the fact that these job images are strongly viewed as 'feminine' (General Secretariat of the Council 2017).

the "leaky pipeline". During this transitional phase, gender plays its role in channelling young graduates into the labour market (General Secretariat of the Council 2017). The mismatch between women's aspirations and their actual career achievements is a cause for concern since well-educated women often end up in jobs where they do not use their full potential and skills (OECD 2012).

An investigation of employment rates for STEM graduates reveals that chances to be employed are significantly lower for women compared to those of men. In 2014, the employment rate of EU women STEM graduates at tertiary level was 76%. This value was more than 10 percentage points higher for men with the same degree and three percentage points lower than the average employment rate of women with tertiary education (General Secretariat of the Council 2017).

These results confirm that STEM fields are strongholds of horizontal gender segregation and even when women choose science-related subjects at university, they are less likely to pursue a science career than men. As shown in Figure 4, most males who graduate in science prefer working as professionals or technicians in physics, mathematics and engineering (71%). Conversely, slightly more than four women out of ten decide to enter the same career in these fields. Among those shying away from STEM, a consistent number of women choose to work as teaching professionals (around 17%).

Figure 4. Distribution of graduates working as professionals and technicians by field of study and occupation (a)



a) First job after graduation
b) "Other" includes all other professional and technical occupation fields

***Source*: "Closing the Gender Gap: Act Now" (OECD 2012)**

The other form of segregation affecting women's career is the vertical segregation, i.e., "the clustering of men at the top of occupational hierarchies and of women at the bottom" (A Dictionary of Sociology 2019). Vertical segregation is associated to career development and it is often referred to as the "glass ceiling" phenomenon. Several studies (UNESCO 2007; OECD 2012) show how women's and men's paths tend to diverge in terms of promotion, with women climbing the ladder more slowly than men. Career advancement opportunities for women are narrowed as they attempt to rise through the ranks and one might relate this fact to family responsibilities, usually heavier for women (e.g., caring for children and for elderly relatives). Undoubtedly, these responsibilities affect the time available for employment, as well as geographic and career mobility. For instance, a recent study (National Science Foundation 2019) concluded that female science and engineering doctorates who are unemployed or out of the labour force in the US are far more likely than men to cite family responsibilities as the reason for not working (27% versus 6%). Similarly, women who are employed with a part-time contract mention family duties as a relevant factor for their choice. Nonetheless, the slower career progress affect women without children and with few household responsibilities as well (UNESCO 2007), thus family is not the only determinant of vertical segregation.

Certain working environments are not welcoming for women and this effect may either be deliberate, or an unintentional effect of an androcentric culture within the organization. The social sphere in the workplace is essential to integrate in an organization and the fact that work-related social events frequently take place outside office hours, at times when women often need to be home to ensure family responsibilities, put women at disadvantage. Indeed, lack of access to strategic information (e.g., funding) is often cited as one of the main arguments for the slower women's career advancement (UNESCO 2007).

Stereotypes and preconceived ideas against women still exist and organizations often ignore that gender diversity could bring different perspectives. This inefficiency in talent management often retains women from assuming key roles and, subsequently, attaining a promotion. Women represent 40% of the global working population (The World Bank Data 2019) and one might expect a similar gender ratio in leadership roles. Yet, they only constitute 34% of managerial positions around the world (World Economic Forum 2018), and even less in the top

roles. The underrepresentation of female leaders might suggest that women face gender biases in the hiring process for leadership positions.

Recent studies (Player et al. 2019) reveal that criteria for the selection of leaders differ by gender and, ceteris paribus, women are judged more harshly than men. More specifically, leadership potential and performance were rated differently between genders. Leadership potential is defined as the sum of qualities that predict future leadership effectiveness (e.g., analytical and strategic thinking) (Silzer and Borman 2017), while leadership performance is represented by current and past events, and the relevant qualities are, for instance, interpersonal skills and the focus on tasks (Player et al. 2019). Results emphasized how leadership potential was the criteria preferred when participants to the experiment ranked male candidates, whilst potential was overlooked when participants ranked female candidates, in favour of performance. These findings indicate that while women's past performance would have to be at least equal to the one of men, women would be at disadvantage in the selection process since their leadership potential would be less likely to be recognized than men's.

Plausible explanations for the difficulty of women in achieving leadership positions might be related to the social role theory (Eagly and Wood 2012) and the role congruity theory (Eagly and Karau 2002). Social roles include both descriptive beliefs, which define masculine and feminine characteristics, and also prescriptive norms that indicate how individuals should be. According to Eagly and Karau (2012), women are typically perceived as, and expected to be, *communal* (e.g., kind, sensitive, nurturant), whereas *agentic* attributes (e.g. determination, self-confidence, competitiveness) are ascribed mostly to men. Needless to say, workplaces where agency instead of communality is expected are unfavourable for women, since leadership is customarily viewed as agentic rather than communal (Koenig et al. 2011). Analogously, the role congruity theory states that "perceived incongruity between the female gender role and leadership roles leads to 2 forms of prejudice: (a) perceiving women less favourably than men as potential occupants of leadership roles and (b) evaluating behavior that fulfills the prescriptions of a leader role less favourably when it is enacted by a woman" (Eagly and Karau 2002, 573). Therefore, even when women embody key leadership traits, they might face negative side effects, since they violate gender-prescriptive norms and expectations.

Additionally, the devaluation of female leaders is more emphasized when leadership is carried out in stereotypically masculine styles (e.g., autocratic or directive), and when they occupy male-dominated roles (Eagly, Makhijani, and Klonsky 1992). Given that STEM roles are viewed as masculine, the above implications apply to those women pursuing a career in science-related fields, who are demanded to break the invisible barriers of the glass ceiling.

1.2.3 Gender pay gap and motherhood penalty

The right to equal pay for equal work is a human right since 1948, year in which the United Nations (UN) adopted the Universal Declaration of Human Rights, a document regarded as a milestone in the history of human rights. Article 23 states that "Everyone, without any discrimination, has the right to equal pay for equal work" (UN General Assembly 1948). Nonetheless, the fact that the UN Sustainable Development Goal (SDG) 8 "Decent work and economic growth" aims to achieve by 2030 "equal pay for work of equal value" (UN 2015) suggests that this human right has not been guaranteed to everyone yet. One of the measures of progress of the SDG 8 is the average hourly earnings of female and male employees and, while we are aware that discriminations may occur on several fronts (among others: race, religion and political beliefs), this section will explore gender discrimination.

Gender pay gap is defined, in its simplest form, as the difference in average wages between women and men engaged in paid employment. This definition represents the so-called "raw" or unadjusted gender pay gap and global estimates are substantially positive (i.e., men earn more than women), ranging from 16% to 22%[14] (ILO 2018). In addition to this, there is widespread recognition that progress in closing the gender pay gap has been slow (ILO 2018).

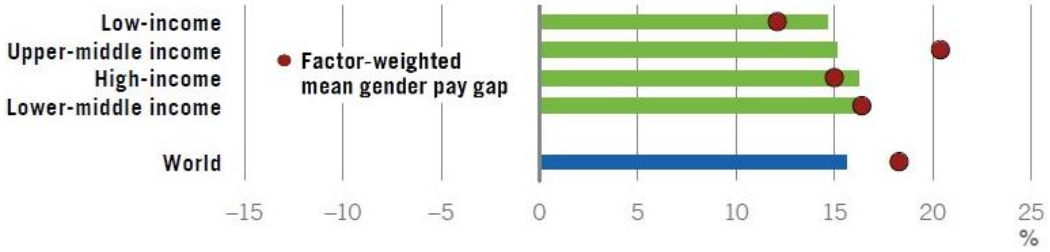
Despite its advantage of being simple to calculate and useful to draw the attention of the general public, the "raw" gender pay gap has limits which cannot be neglected. Specifically, the two confronted populations, i.e., female and male workers, present several specific characteristics which may cause wage disproportions and should be

[14] The "Global Wage Report 2018/19" (ILO) uses different combinations to measure the raw gender gap: mean/median and hourly/monthly wages. The value of 16% refers to mean hourly wages, whilst 22% represents median monthly wages, reflecting the fact that in most countries women and men differ with respect to working time (i.e., part-time work is more prevalent among women than men).

considered when estimating: differences in educational attainments; lower earnings in the fields and positions in which women are concentrated; differences between female and male participation rates in part-time and full-time work, higher presence of women in the public sector rather than the private sector (ILO 2018; UNESCO 2007).

Notwithstanding, even when these factors are accounted for and a more accurate indicator[15] is built, i.e., the "factor-weighted" gender pay gap[16], inequality persists (Figure 5). Even tough in some cases the latter is smaller than the unadjusted gender pay gap, in most cases it is wider, leading to an increase of the global estimate by three percentage points, hence reaching 19%.

Figure 5. Comparison of raw and factor-weighted gender pay gaps by countries income level (mean hourly wage)



***Source*: adapted from "Global wage report 2018/19: what lies behind gender pay gaps" (ILO 2018)**

The next step in our analysis of the gender pay gap is to deconstruct it into an "explained" and an "unexplained" part. The explained gap represents the part of the gender pay gap which can be explained by differences in education and labour market characteristics, while the unexplained gap refers to the portion that cannot be explained by differences in those attributes (ILO 2018). However, it should be noted that naming a portion of the gap as "explained" does not imply that this part is justified, since it may itself stem from gender inequalities in education, work or in the private sphere, e.g., at home.

[15] Another merit of the factor-weighted gender pay gap is the lower difference between mean and median values, if compared to such differences in the standard or "raw" measure. This constitutes an advantage since analysts often choose mean or median values subjectively, sometimes leading to controversy in policy-making (ILO 2018).

16 The factor-weighted gender pay gap is not equivalent to the adjusted gender pay gap: the latter requires the use of other techniques, for example the identification of a counterfactual distribution, to identify and exclude that part of the gap arising from differences in endowments between women and men (ILO 2018).

After operating the division, what emerges is that the gender pay gap remains mostly unexplained, with education accounting for less than 1% in high-income countries on average. This finding is hardly surprising since in developed countries the educational attainment of working women is often higher than that of men (OECD 2019a). More surprisingly, lower educational attainment is not a relevant explaining factor of the pay gap in most low- and middle-income countries either (ILO 2018). Analysing the full picture, this is an evidence of the lower returns from education of women compared to men. Women's achievements in educational attainment over recent decades have, thus, only managed to reduce rather than to eradicate the pay gap.

Although there exists a large body of literature on the role of traditional economic variables in explaining labour market outcomes, there is almost always a sizeable component that is not explained by these variables. Consequently, researchers have started going beyond traditional economic models to investigate the role of unconventional factors, and, with regard to gender, differences in psychological attributes have been proposed as explaining factors for women's lower wages and lower representation at the top of hierarchies. For example, women have been found to be less willing than men to negotiate and compete, and to be more risk averse (Marianne Bertrand 2011; Croson and Gneezy 2009).

In view of the objectives of this thesis, another factor which assumes particular relevance in explaining the pay gap is the concentration of women in a limited spectrum of sectors and occupations, i.e., occupational segregation. In fact, while higher educational levels generally lead to higher wages, pay rates of highly feminized sectors (e.g., teaching, nursing) are significantly lower than others, for the same educational levels (ILO 2018; UNESCO 2007). The knowledge and skills required for occupations with high female representation tend to offer lower status and rewards. Thus, the undervaluation of women's work combined with good employment prospects in STEM should act as an incentive in attracting women to STEM, as remuneration in these "masculine" sectors is higher than in traditionally "feminine" sectors. However, even when women decide to enter STEM professions in sectors such as ICT, persisting stereotypes and prejudices in the workplace often lead to biased recruitment and promotion decisions. In fact, women tend to be

employed in less paid occupations such as ICT management, rather than ICT software development (ILO 2018).

Research on US college-educated STEM workers (Carnevale, A., Smith, N., and Melton, M. 2011) has provided evidence for women earning less than men on an annual basis, regardless of their major within STEM. While the gender wage gap is less severe in STEM fields than in the non-STEM fields (Lim 2016), there exists a gender discrimination in pay rates that sheds light on other relevant issues. Specifically, the degree of feminization of the major, namely the proportion of women in a given major, seems to be inversely related to the earnings of women. In other words, the more women in a certain major, the lower the earnings for them. For example, (Carnevale, A., Smith, N., and Melton, M. 2011) observed that the major which offered the highest earning, i.e., engineering, was also the one with the highest gender pay gap among STEM majors: women were out-earned by men by $17,000 (per year). Additionally, engineering was also the major in which women accounted for the lowest rate (16%). Conversely, biological and life sciences – the most preferred STEM majors by women, with a female participation of 55% – featured the lowest gender wage gap ($12,000 per year). Thus, segregation and devaluation are important concepts when discussing gender pay gap either in non-STEM occupations or in STEM occupations.

Some countries have demonstrated their commitment to tackle educational and occupational segregation[17]. Programmes involve specific actions such as raising awareness of STEM careers for women, organizing specific job fairs, financial support for STEM programmes targeting women and offering internships and career advice (G20 2018). In general, a sizeable amount of factors that caused gender discrimination in the past have gradually disappeared over the years – e.g., thanks to the implementation of anti-discrimination policies in education and employment – except for one: motherhood. Even when women today become engineers, lawyers and heads of states, they are expected to bear most of the responsibilities in raising children. The effects of children on the careers of women relative to men are significant around the world and this phenomenon is commonly

[17] For more details, consult "Joint Declaration, G20 Education and Employment Ministerial Meeting, 6 Sep 2018, Mendoza, Argentina.

referred to as the "motherhood penalty"[18]. Thus, alongside the dynamics of the gender pay gap, there exists a relevant body of research investigating the "motherhood pay gap", defined as the pay gap between mothers and non-mothers. This new concept entails a re-orientation of traditional gender pay gap analysis: instead of focusing on the reasons why women receive unequal pay for equal work, in this case the attention shifts on why they receive unequal pay as a result of motherhood – but not necessarily for equal work.

Studies on the negative relationship between children and women's wages are well documented and lower earnings for mothers may arise from a wide range of factors, for instance: lower labour market participation; work interruptions or reduction in working time; employment in more family-friendly occupations and sectors which offer lower salaries; hiring and career advancement decisions of employers driven by stereotypes on mothers. The penalty can be as low as 1% or less (Canada, Mongolia or South Africa) and as high as 30% (Turkey) (ILO 2018). With regard to women working in STEM, empirical analysis shows that they decrease their labour supply significantly less if they have small children, when compared to women employed in other fields (Schlenker 2015).

Recent studies (Kleven, Landais, and Søgaard 2018) indicate that even in progressive Scandinavian countries, such as Denmark, most of the remaining gender inequality in earnings is due to children. Specifically, motherhood penalty in earnings is close to 20% in the long run. Another alarming finding concerns the evolution of such gap over time: the portion of child-related gender inequality has increased dramatically, from around 40% in 1980 to around 80% in 2013. Therefore, the remaining gender pay gap in Denmark concerns approximately entirely motherhood.

In addition, empirical findings point to the existence of a "fatherhood pay gap", but instead of suffering a penalty, fathers appear to earn a wage premium over non-fathers. One possible explanation is an increase in men's work hours and effort following a child's birth; another interpretation pertains to fatherhood as a valued characteristic of employers, probably indicating greater work commitment and

[18] For a full review on the topic, "The motherhood pay gap: A review of the issues, theory and international evidence" (Grimshaw and Rubery 2015).

stability. However, studies on the topic are scarce and mainly refer to high-income countries[19].

Taken together, these findings provide evidence of a strongly gendered response to parenthood in the labour market, with relatively long-term consequences, especially for mothers. A cultural shift appears necessary to tackle gender disparities in wages: the perception of parenthood should be more balanced between mothers' and fathers' responsibilities and inequalities should be considered as a family issue and not a woman's issue.

1.3 Economic benefits of gender equality in STEM

We have so far illustrated the main gender patterns in STEM, both with regard to education and training and labour market. Moreover, it has been often highlighted that achieving gender parity overall, hence even in STEM, is crucial to fulfil human rights. In the following we will investigate how gender equality in the labour market is not only an issue related to the ethical sphere but how it also affects economic efficiency.

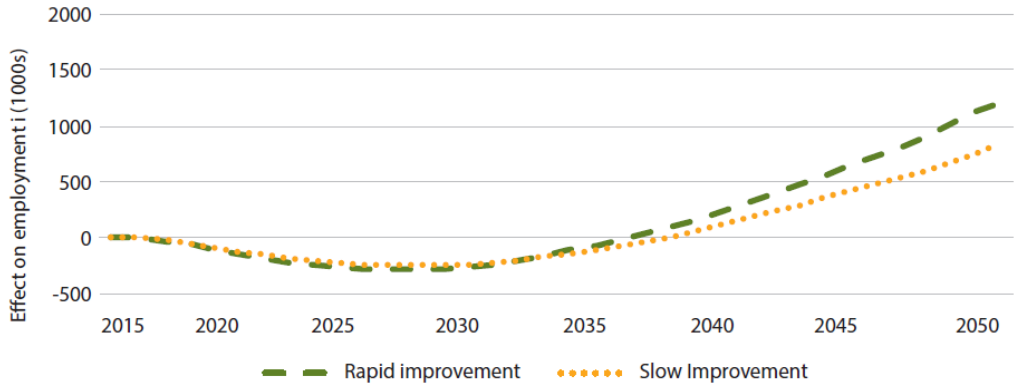
More specifically, an investigation of the economic advantages of achieving gender equality in STEM reveals how the phenomenon benefits not only women, but the entire population. Empirical results indicate that high-tech human capital is significantly positively correlated with economic growth (Tsai, Hung, and Harriott 2010) and, as much as the labour market is concerned, eliminating the gender gap in STEM would help solving some major issues previously illustrated, such as skill shortages, consequent recruitment difficulties and bottlenecks – a problem widely spread among countries (European Commission 2014). Furthermore, studies confirm that EU employers share concerns about current and future skill shortages (European Parliament 2015; European Migration Network 2011). The lack of qualified workforce appears to be caused by insufficient supply of home-grown talent (i.e., EU citizens) and by difficulties in attracting talents from other parts of the world, as highly skilled STEM professionals prefer working in countries such as the United States, Canada and Australia. Attracting more women to STEM would

[19] For example, "Parenthood and the earnings of married men and women" (Lundberg and Rose 2000) or "The Fatherhood Bonus and The Motherhood Penalty: Parenthood and the Gender Gap in Pay" (Budig 2014) for the United States.

help Member States satisfy labour demand through a better allocation of EU resources, rather than recurring to external labour supply. Moreover, according to forecasts, around two-thirds of the estimated job vacancies for STEM-related professions will replace retiring workers (European Parliament 2015). In spite of the rise in absolute terms in STEM education – with an upward trend for university graduates and a downward tendency for VET graduates (European Parliament 2015) – demographic patterns will likely lead to STEM shortages, since the number of young graduates will be relatively low if compared to those retiring. In rapidly ageing economies such as the EU, engaging more females in STEM labour market could mitigate the effects of a shrinking workforce.

A glance at Figure 6 reveals how closing the gender gap in STEM education would positively impact employment in the EU in the future. The total employment rate would reach almost 77% by the year 2050 (EIGE 2019) – for a better understanding of the scale of the phenomenon, the above-mentioned rate recorded its apex in 2018 at 73.1% (Eurostat 2019). Nevertheless, it should be pointed out that forecasts depend on the pace of improvements: more precisely, the number of new job positions is expected to rise by 850,000 if progress will be slow, whilst rapid improvements would lead to 1,200,000 new jobs by 2050.

Figure 6. The effect of closing the gender gap in STEM on total employment (thousands of new job positions)

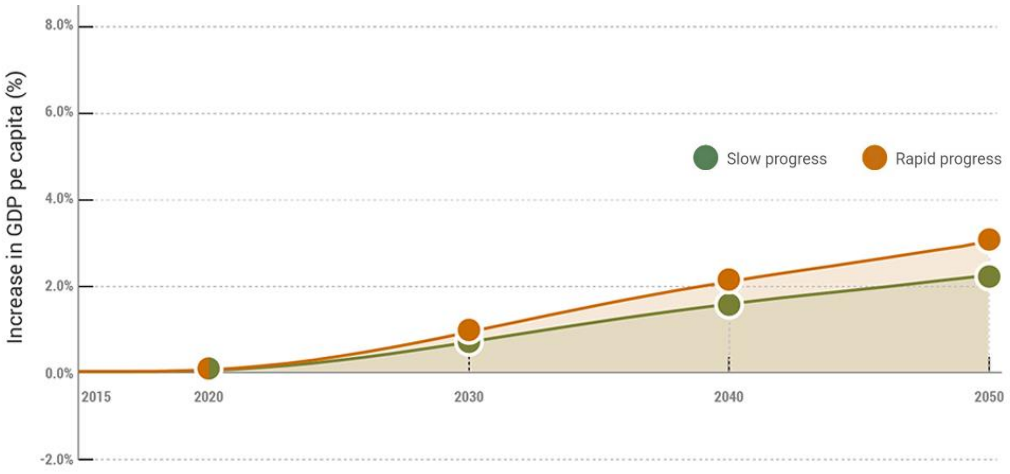


***Source*: "Economic benefits of gender equality in the EU: how gender equality in STEM education leads to economic growth" (EIGE 2017)**

Besides the positive direct effects on the labour market, these new jobs would likely be denoted by high productivity, due to the highly skilled workforce and high added value positions that involve STEM (EIGE 2017). The concept of productivity is, in turn, inextricably linked to Gross Domestic Product (GDP), thus, another

macroeconomic benefit from attracting more women to STEM would be GDP growth (Figure 7). Specifically, an increase by 3% of GDP per capita is forecast at EU level by 2050. In monetary terms, these results could lead to an improvement in GDP by EUR 820 billion in 2050 (EIGE 2017). These figures refer to the hypothesis of rapid improvement in gender equality; notwithstanding, even though the EU shall adopt a slower pace, results would be likewise notable: GDP per capita would move upward by 2.2 percentage points and total GDP would grow by EUR 610 billion.

Figure 7. The effect of closing the gender gap in STEM on GDP growth (%)



***Source*: "How gender equality in STEM education leads to economic growth" (EIGE 2019)**

In addition to the above findings, increased employment of women in STEM would boost the long-term competitiveness of the EU economy. The balance of trade would improve, with exports estimated to rise by about 0.7 % and imports forecast to decline by up to 1.2 % by 2050 (EIGE 2017).

The illustrated benefits of closing the gender gap in STEM rely on one assumption: a smooth transition from education to work. Despite the efforts exerted by several institutions, however, not all women who study STEM subjects become professionals in these fields (a large number of them, for example, choose to be a teacher), as we have observed in section 1.2.2 of this chapter; this decision inhibits the full use of their potential and skills (OECD 2012).

In conclusion, women constitute around half the world's population (World Bank Data 2019), but their contribution in shaping the present and the future is far below their potential. Macroeconomic consequences deriving from a gender divide undermine global growth and, in spite of significant progress in recent decades,

education and labour markets have proved time and again fertile ground for gender segregation.

The challenges of economic growth and gender equality are strictly connected. On one hand, growth is necessary to give women the opportunities they need; on the other hand, women's contribution to economic development is vital to achieve gender equality and prosperity.

CHAPTER II

A FIELD EXPERIMENT: GENDER DIFFERENCES IN NON-COGNITIVE FACTORS AND THEIR INFLUENCE ON LIFE OUTCOMES

2.1 Experimental economics: lab, field and lab-in-the-field experiments

Experimental economics is a relatively new branch of economics which applies experimental methods to investigate economic questions[20]. Economists conduct experiments for well-defined reasons. They test a theory by comparing predictions and observations, and if observations do not conform to the predictions of the theory, they investigate the causes of such failure. Another purpose of experiments is to detect empirical regularities to form a new theory which explains why such regularities occur. Experiments are also useful to compare environments using the same institution[21] and vice versa. Finally, conducting experiments is a wat to test institutional designs and policies (Smith 1994).

Experiments represent the core of the discipline and they can be distinguished mainly into two categories, lab experiments and field experiments, which differ on several dimensions[22]. For instance, lab experiments are conducted in a laboratory, whereas field experiments are carried out in a naturalistic environment. Another distinction is based on the population: since lab experiments are typically conducted on university campuses, they usually rely on students, while field experiments do not. Both types of experiments yield advantages and disadvantages. In lab experiments, on one hand, the experimenter can maintain a high level of control, thus simplifying the replicability and removing the influence of factors which could confound the study – in other words, *internal validity* is assured. On the other hand, however, the attempt to abstract from the naturalistic setting where individuals

[20] The Nobel Prize in Economic Sciences assigned to Daniel Kahneman and Vernon L. Smith in 2002 established the relevance of experiments as a tool in empirical economic analysis.

[21] An institution defines the language (messages) of communication, the rules that govern the exchange of information, and the rules under which messages become binding contracts. An institution is defined by the experimental instructions which describe the messages and procedures (Smith 1994).

[22] Further subcategories of experiments exist, such as artefactual field experiments. For a full review on the characteristics of each type of experiment, please refer to Kagel, John H. and Roth, Alvin E. *Handbook of experimental economics*. Princeton: Princeton University Press (1995).

typically act raises questions on the quality and relevance of their decisions for research purposes. In fact, individuals are aware their decisions are being studied, and students represent a population with intrinsic characteristic (e.g., early adults, educated, low or no income) which do not portray the general population. Taken together, these considerations emphasize how lab experiment often fail to provide sufficient *external validity*, as it is not always possible to generalize causal inferences drawn for a particular population and setting to others, which could involve different populations, outcomes or contexts (Banerjee and Duflo 2017; Uri Gneezy and Imas 2017).

Conversely, field experiments involve a population of theoretical interest chosen by the experimenter. Furthermore, since they are conducted in a natural context, individuals do not think their actions are being observed, and their behaviour might be considered as more indicative of a realistic situation, hence supporting external validity. Despite these valuable benefits, the experimenter's control is severely restricted (i.e., internal validity is minimized) and the replicability of the experimental setting is more difficult, as it is often situation-specific. Moreover, the specificity of the experiment makes the generalization of the findings and the comparison to other situations more complicated (Uri Gneezy and Imas 2017).

Whether the experimenter decides to design one type of experiment or the other, he must inevitably consider the above complications which, notwithstanding, can be minimized through specific methodologies, such as randomization. Moreover, researchers have sought to combine characteristics of both settings, giving life to new subcategories of experiments[23], such as lab-in-the-field experiments: they are conducted in a naturalistic environment on a theoretically relevant population, but using a standardized lab paradigm which allows control and comparisons across contexts and populations.

[23] The literature has often highlighted the difficulty to draw single, sharp lines between different types of experiments, since several dimensions are involved and inevitably trade-offs between the different categories arise. For an example of proposed taxonomy, see Harrison, G. W., and List, J. A., 2004. "Field Experiments." *Journal of Economic Literature*, 42 (4): 1009-1055.

2.2 A field experiment: The gender gap and the Italian Mathematical Olympiad

The achievement of gender equality would contribute to reach the full potential of humanity. Particularly, in Chapter I, we focused our attention on STEM fields, since their relevance in today's world is prominent. Despite significant progress in recent decades, education and labour market are still affected by gender biases at all levels. Traditional policies designed to close the gender gap, such as the implementation of gender quotas, parental leave and child-care policies have not always yielded positive results; in some cases, they have been totally ineffective, leading to unexpected opposite results[24]. In order to increase the effectiveness of policies aimed at achieving gender equality, it is necessary to better understand the determinants of the gender gap.

The research project presented in this thesis represents a policy-oriented investigation of optimal mechanisms aimed at closing the gender gap. It was conducted in collaboration between Valeria Maggian (Ca' Foscari University of Venice), Natalia Montinari (University of Bologna) and Antonio Nicolò (University of Padua and University of Manchester)[25]. I collaborated to the implementation of the project since I was awarded an internship grant for activities of research assistance by the Venice centre in Economic and Risk Analytics for public policies (VERA Centre). The experiment was organized in collaboration with the Italian Mathematical Union during the Italian Mathematical Olympiad, an annual competition for high school students. Over the years, participation rates have proved to be unequal between genders, especially in latter stages of the competition. For instance, in 2017, around 200,000 students from 1,500 schools participated at the first stage of the competition; interestingly, female participation dropped from 50% to 10% from the first to the second stage of the competition, a phenomenon that cannot be explained by gender differences in performance. The field

[24] Antecol and colleagues (2016) analysed the results of gender-neutral tenure clock stopping policies adopted by most universities in the United States. Assistant professors are typically evaluated for tenure near the end of a fixed probationary period, which usually lasts about seven years. The fixed probationary period, however, disfavour those who experience temporary negative productivity shocks during that period, due, for instance, to childbirth and parenthood. Thus, these policies allow assistant professors to stop their tenure clock for one year. Results, however, failed to show evidence that such policies helped women. On the contrary, they substantially reduced females' tenure rates while substantially increasing males' one.

[25] The research project was financially supported by a research grant from Einaudi Institute of Economics and Finance (EIEF) (http://www.eief.it/eief/index.php/grants-2018) and by a SID grant from the University of Padua.

experiment, thus, has a dual purpose: on one hand, it investigates the causes of women's lower participation to the Italian Mathematical Olympiad, and on the other hand, it aims at evaluating the efficiency and effectiveness of different policy interventions. The choice of conducting a field experiment was dictated by the wish to assure both external and internal validity. Indeed, a laboratory experiment would allow tight control on the analysed variables, but external validity may not be sufficient. Another available method is the investigation of observational data, but drawing causal inference would likely be inconclusive, since the implementation of a policy might be related to changes in societal attitudes of women or about women. By means of a field experiment, the possible determinants and solutions to the gender gap are investigated in a randomized framework, where both the external and internal validity are assured.

The choice of the Mathematical Olympiad is not a random one. Two core features ensure that the research questions are properly addressed: it is a competition and it is a math competition. A series of recent studies indicates that attitude towards competition is connected to the starting salary and industry choice of MBA students (Reuben, Wiswall, and Zafar 2017), and to actual and expected labour market earnings. More specifically, not only do individuals who are overcompetitive expect to earn significantly more – with gender differences in competitiveness accounting for 18% of the gender gap in earnings expectations (Reuben, Wiswall, and Zafar 2017) – but they actually earn more (T. Buser, Geijtenbeek, and Plug 2015; Reuben, Wiswall, and Zafar 2017). Furthermore, the willingness to compete in the lab has been identified as an important entrepreneurial trait that shapes choices and outcomes in the field (Berge et al. 2015). The level of competitiveness also affect educational choices, such as taking an entry exam to a highly selective university (Ors, Palomino, and Peyrache 2013). Mathematics, the other salient characteristic of the Italian Math Olympics, has been recognized as a catalyst for success. Joensen and Nielsen (2016) found that girls who complete more math-intensive college degrees choose more competitive careers, climb higher up the career ladder and have greater incomes. Mathematics is arguably among the key skills needed to succeed in STEM and several studies highlight the close relation between math and competition. For instance, Niederle and Vesterlund (2010) observed that gender differences in competitive attitudes (i.e., females being less competitive than boys)

may distort mathematics test scores, thus gender differences in math skills might be misinterpreted since they could not reflect actual differences in performance. Given that both attitude towards competition and the choice of math specializations are important drivers of professional outcomes, women's lower competitiveness and lower presence in math-intense courses may partially explain the observed gender gap in STEM.

The experiment proceeded in two main steps. Firstly, all schools participating in the Math Olympics were asked for their availability to participate in the project and for characteristics about their institution (e.g., total number of female and male students, statistical information about their students' score at the Math Olympics, etc.). Secondly, schools were randomly selected among a subsample that satisfied some objective criteria (i.e., the size of the school, a maximum ratio of 70-30 between girls and boys) and were randomly assigned to the control and the treatment groups – for more details on the randomization and sampling procedure, please refer to Chapter III. The three concrete policy interventions tested, which correspond to the treatments implemented, were: (a) monetary incentives (b) gender quotas (c) role models.

According to a traditional economics approach, monetary prizes might induce higher participation, effort and performance by female students. Therefore, in this experiment, selected schools were given monetary prizes to be assigned to the best students of the school, namely those who scored highest at the Italian Math Olympics at a school level (regardless of their gender.) Gender quotas were implemented in other treated schools with a slightly different version of the contest: monetary prizes were assigned to the best students at the Math Olympics as the latter treatment, but prizes were equally split among the best male and female performers. In doing so, girls' chances to win were equal to boys'. Lastly, in another treatment, role models were implemented by advertising a poster in schools which invited students to watch a video; the video showed interviews of successful women in STEM which, during high school, had participated in the Mathematical Olympiad and encouraged girls to do the same. Gender quotas are designed to encourage women to enter competition, in this specific case a math competition, and the ultimate goal is achieving a more gender-balanced pool of students selected in the

first steps of the competition[26].

2.3 A questionnaire on non-cognitive factors

As part of the research project, students participating to the experiment (both those belonging to the control and treatment groups, except for the role model treatment) were invited to fill in an online questionnaire at school, which can be found in the appendix. The questionnaire gathered: (a) information related to scholastic performance, e.g., grade point average and grades in scientific subjects (b) information on the sociocultural context of the student, e.g., parents' educational attainment and occupation, composition of the family (c) measures of several non-cognitive factors, whose definition often varies. For instance, some describe them as "non-traditional predictors that represent behavioural, attitudinal, and personality constructs, primarily derived from psychological theories" (Allen, Robbins, and Sawyer 2009, 2). Others explain that "[n]on cognitive skills are personality traits that are weakly correlated with measures of intelligence, such as the IQ index" (Brunello and Schlotter 2011, 5). These skills are at the core of the concept of emotional intelligence explored by social psychologists and human resource management specialists, e.g., Goleman (1996). Despite theorists' efforts to properly define non-cognitive skills, our focus, in light of the objectives of this work, is on the role these factors might play in educational and professional outcomes, particularly for girls and women in STEM.

Economic research has overlooked these abilities in favour of literacy in the areas of reading, mathematics and science (cognitive abilities) – see Box 1 for more information on the largest international assessment on student outcomes. The most probable reason behind this choice lies in the difficulty to attribute economic outcomes to psychological traits (M. Niederle 2015). However, non-cognitive skills are at least as important as cognitive skills for an individual's success (Brunello and Schlotter 2011). Economists have been focusing mainly on two other possible sources of gender differences: discrimination and human capital accumulation (i.e.,

[26] Some argue that gender quotas negatively affect performance levels. However, studies disconfirm this hypothesis, finding that the minimum performance threshold is not impacted by the introduction of gender quotas. For more details, see Niederle, M., Segal, C. and Vesterlund, L. (2013). "How costly is diversity? Affirmative action in light of gender differences in competitiveness". *Management Science*, 59:1-16.

educational attainment before labour market entry and accumulated experience in the labour market) (M. Niederle 2015). These traditional explanations, however, have often failed to explain the observed gender gap in STEM – in Chapter I, for instance, we showed evidence for equal or higher women's performance in education. Gender differences in preferences and attitudes might make some professional paths more appealing for women and others for men. Therefore, the purpose of the questionnaire is twofold: on one hand, we intend to verify whether girls and boys differ with respect to non-cognitive skills and, on the other hand, we want to evaluate the influence of non-cognitive factors on educational outcomes (e.g., performance in mathematics) and, ultimately, on the underrepresentation of women in STEM fields.

Through scientifically validated methods, we measured attitude to competition, risk and time preferences, self-efficacy, self-control and self-esteem. We often borrowed tools developed in psychology to measure non-cognitive skills such as self-esteem and the existence of stereotypes. The survey was conducted in accordance with guidelines from the Data Monitoring Board of Ca' Foscari University of Venice and was implemented through Qualtrics, an online platform. The questionnaire was administered between October 2019 and January 2020, and those who decided to respond to it were required a written informed consent by students' parents (if the student was under 18 years old) or by the student himself (see appendix). In order to avoid any tendency to answer questions in a way that pleases the researchers (*social desirability bias* and *experimenter demand effect* [27]), the consent described the macro objectives of the study (namely, the analysis of students' academic and professional aspirations), without giving detailed information on the questionnaire items. Students started and completed the questionnaire without interruptions in their classrooms or laboratories; moreover, when possible, all the students of a given school filled in the questionnaire on the same day or, if not possible, in close proximity. This choice was intended to avoid any contamination in students' responses. To rule out the hypothesis that the order

[27] The experimenter demand effect is a problem which affects potentially every experiment, threatening both internal and external validity of a study. It refers to participants' behavioral changes in their response due to an inference on the experimenter's hypothesis. For more information, see de Quidt, J., Vesterlund, L., Wilson, Alistair, J. "Experimenter demand effect" in *Handbook of Research Methods and Applications in Experimental Economics*, ed. Schram, A. and Ule, A. Edward Elgar Publishing, (2019) 384-400.

of items could influence answers, the sequence in which the various items appeared was random. Finally, by means of the lottery, one hundred gift cards (for a value of €10) were extracted from all those students who completed the survey.

The remainder of this chapter is devoted to the literature overview of each investigated non-cognitive factor, and information on the methods adopted to measure them will be given. Results of the questionnaires analysis will be presented in Chapter III.

BOX 1. PISA: student's performances and aspirations. The role of a growth mindset

The OECD Programme for International Student Assessment (PISA) is the most comprehensive international assessment of student learning outcomes. It is administered every three years to 15-year old students, and the latest edition (PISA 2018) encompassed all 37 OECD countries and economies and 42 partner countries and economies. PISA aims at establishing whether students' human capital near the end of compulsory education is adequate to actively contribute to society, and the domains assessed are mathematics, science and reading. Given the objectives of this thesis, we will focus on mathematics and science results.

On OECD average, boys slightly outperformed girls (just by five score points) in mathematics, and girls marginally outperformed boys in science (just by two score points) (OECD 2019c). Italian students' performance did not significantly differ from the OECD average in mathematics, whereas it was lower than the OECD average in science. When it comes to gender patterns among Italian students, males outperformed girls in mathematics by sixteen score points (a wider gap than the OECD average). Conversely, females attained slightly better results in science (by two score points) (OECD 2019b).

Considering only literacy in mathematics and science, however, would not provide a complete picture of the situation. Other variables investigated in PISA reveal equally crucial factors in students' learning experience. Of all the judgements students make about themselves, the most influential on performance is how much they believe they can be successful at a task, i.e., their level of self-efficacy. Self-efficacy is intrinsically linked to the perception of intelligence and the literature (Dweck 2008) has emphasized the benefits of adopting a "growth mindset". People with a growth mindset, or incremental theory of intelligence, "think of intelligence as a malleable quality that can be developed" (Blackwell, Trzesniewski, and Dweck 2007, 247). By contrast, those who believe intelligence is a fixed trait that cannot be changed endorse a "fixed mindset". Studies (Blackwell, Trzesniewski, and Dweck 2007) suggest a positive influence of a growth mindset on students' accomplishments, without denying possible differences between individuals in the learning speed, and admitting that students might have different capacity. Notwithstanding the above, even when students on

both ends of the continuum demonstrate equal intellectual ability, their concept of intelligence affects their reaction to academic challenges. Specifically, the authors suggest that when students extensively focus on assessing their ability and any difference with others, they renounce to challenges if they forecast a failure. Conversely, those who concentrate on their potential endorse more positive beliefs about effort, benefit from greater motivation to acquire new skills and do their utmost to master challenging tasks. In this regard, PISA 2018 found that the majority of students endorsed a growth mindset[28] – slightly more than 60% on OECD average and an almost equal share for Italy, that is, 59% (OECD 2019d; 2019b).

An incremental view of intelligence appears to influence mathematics performance, in the way that students who hold a growth mindset yield higher math grades in comparison to those who endorse a more fixed notion of intelligence (Blackwell, Trzesniewski, and Dweck 2007). Moreover, effects are long-lasting – the study sought to measure the effect of teaching students a growth mindset at the outset of middle school and then assessing their math achievements through the seventh and eighth grades, and the positive influence of such a mindset on math performance was assessed throughout the years.

Academic performance, thus, is not the only factor which impacts students' learning experience and future aspirations. PISA results (OECD 2019c) offer a valuable insights into boys' and girls' ambitions and, in general, one in three students reported an interest in a science-related career. However, when we decompose results by type of occupation, greater gendered patterns arise. Specifically, 15% of boys but only 7% of girls reported that they expect to work as science and engineering professionals; in Italy those figures were, respectively, one in four boys and one in eight girls (OECD 2019b). The most striking difference concerns ICT tough: only 1% of girls reported the desire to work in this sector, compared with 8% of boys (with Italian results akin to the general OECD trend). Professional expectations were even more gender biased for top performing students. Finally, the increasing gender gap in interest in these occupations over the past few years should be a further cause for concern.

2.3.1 Competitiveness

Research on competitiveness has been subject to major paradigm changes over time. Its origins date back to the pioneering work of Triplett (1897) who studied concepts such as competitive instincts and mental attitudes during performance in the domain of psychology. Years later, researchers started including context and reward structure as fundamental elements to study competitive behaviour; in the

[28] For more information, see PISA 2018 Database at http://dx.doi.org/10.1787/888934030724.

work of Deutsch (1949) competition is a polar opposite of cooperation and is highest under "winner take all" conditions, i.e., when only one person receives all the available rewards. Other methods of investigating competitiveness considered it as an intrinsic personality trait which drives behaviour in several dimensions and requires the perception of a rival, who represents a standard against which the individual's performance is measured. Later on, competitiveness assumed a broader connotation and a widely accepted definition of the concept is "the desire to win in interpersonal situations" (Helmreich et al. 1980). Most recent approaches to competitiveness highlight its multidimensionality which, in contrast to some previous ideas, can encompass both beneficial and detrimental aspects of behaviour (Orosz et al. 2018).

Turning to the domain of economics, competitiveness is arguably among the most explored areas of gender differences in the economic literature, and several meta-analyses have been conducted to date (for instance, Croson and Gneezy (2009); Niederle (2015)). The main reason for its investigation is to try to explain specific labour market outcomes, such as horizontal and vertical gender segregation.

An extensive review of experimental economics by Niederle (2015) reveals large gender differences in attitude towards competition. As a preliminary observation, the author emphasizes how experiments aimed at investigating gender differences in competitiveness differ from most of the other economic experiments. The peculiarities involve two issues: first, the use of real effort tasks and second, the fact that experimental results depend both on the gender of the participant and on the gender of other subjects. Evidence shows how women shy away from competition with men, and even when deciding to compete, they underperform. Interestingly, gender differences are particularly striking when performance is measured in tasks that are not stereotypically female, such as math tasks. This pattern raises questions on the sensitivity of the results to the nature of the task used in experiments.

The first experiment seeking to understand whether women and men choose differently in competitive incentive schemes was designed by Niederle and Versterlund (2007). Since then, a series of papers [29] have applied the same experimental design (in some cases introducing minor modifications) and have

[29] For a full list of papers, see Niederle, M., "Gender" in *Handbook of Experimental Economics, Vol. 2*, eds. Kagel, J., Roth, A. E. (Princeton, NJ: Princeton University Press, 2015), 481-562.

reached similar results. The original experiment asked participants to solve a real effort task, that is, adding up sets of 5 two-digit numbers for 5 minutes, and the score was given by the number of correct answers. Participants were grouped with other people to form groups of 4 (2 women and 2 men), thus they could see each other and the respective gender (even tough gender issues were never discussed during the experiment). The incentive schemes were both competitive (piece rate) and noncompetitive (tournament)[30], and results proved to be strongly driven by gender: men selected the tournament twice as much as women when they were asked to choose their compensation scheme for the next performance, for any performance level. Specifically, 73% of men selected the tournament, whereas only 35% of women chose the same. Consequently, if fewer women entered the competition, fewer women won it. As suggested by Niederle (2015), these figures show that high-performing women enter the tournament too little and low-performing men too much. Another result of the experiment was the improved performance of women when moving from a competitive to a noncompetitive incentive scheme. The direct implication of this finding is that women and men with the same ability will likely reach similar performances in noncompetitive environments, but when women and men compete against each other, women will likely perform worse. In other words, real abilities of women and men may be distorted in mixed-gender competitions, with women's performances being severely compromised.

Another related paper (U. Gneezy, Niederle, and Rustichini 2003) investigated gender differences in both competitive and noncompetitive settings, and it introduced a new element, that is, single-sex tournaments. Besides corroborating Niederle and Vesterlund (2007) results for mixed-sex tournaments, the authors concluded that women perform highly when competing against other women. Taken together, these findings indicate that women do not compete against men. Notwithstanding, further research is needed before firmly stating that women are less competitive, as other factors could interplay in competitive situations, such as the gender composition of a group.

[30] A competitive incentive scheme was, for instance, a piece rate pay of $0,50 per correct answer, whereas a noncompetitive scheme was a tournament in which only the participant who solved the largest number of correct problems in the group received $2 per correct answer, while the others received no payment. For a detailed description of the experimental setting see Niederle, M. and Vesterlund, L., 2007. "Do Women Shy Away from Competition? Do Men Compete Too Much?" *The Quarterly Journal of Economics*, 122(3), 1067-1101.

The studies reviewed so far are laboratory experiments. After having established the existence of gender differences in competitiveness in laboratories, the next step is investigating whether such differences exist likewise outside labs. A vast literature of field experiments on the topic has developed and overall, field research confirms the gender differences documented in the laboratory – for an overview of this literature, Niederle and Vesterlund (2011). Given the objective of this thesis, that is, exploring the possible determinants of the underrepresentation of women in STEM, particular attention will be given to field experiments investigating competitiveness in education. Particularly, researchers have tried to understand whether test scores (commonly used as indicators of performance) reflect real differences in skills, or they rather conceal different responses to competitive environments. To answer this question, Ors and colleagues (2013) studied performance in a competitive entry exam to a highly selective business school in France (HEC) – to give an idea of the competitiveness level, only one in ten students is accepted every year. Results revealed that men performed substantially better than women. The authors, however, go beyond simply measuring performance in HEC entry exam: they analyse students' performance in similarly stressful but less competitive situations, namely the national high school exam and, for HEC admitted students, their performance in the first year. Interestingly, they find that females significantly outperform males in both situations, thus they conclude that differences in the gender gap between competitive settings (the entry exam) and less competitive environments (the high school exam and the first-year performance) stems from a distinct response to competition based on gender.

Notwithstanding, the experimental evidence, both in the laboratory and in the field, cannot directly assess the external validity of competitiveness, i.e., whether gender differences in attitude towards competition impact education and labour market outcomes. Indeed, any experimental evidence cannot be directly linked to education and professional choices on a scale that represents the general population (M. Niederle 2015). In order to overcome this research pitfall, Buser and colleagues (2014) combined a good measure of competitiveness with field outcomes. In their study, the authors explore the role of gender in education choices of 9th graders in the Netherlands who, after sharing the same track over the first three years of pre-university school (grades 6-9), decide among four options for their last three years

of high school. The available options are: Mathematics, Biology, Economics and Literature. This order reflects the degree of math and science intensity of the tracks, as well as the associated prestige. Moreover, it mirrors what the highest achieving pupils choose and how likely they are to go to university. As a measure of competitiveness, they conduct experiments in schools which largely correspond to the one designed by Niederle and Vesterlund (2007), except for minor changes (e.g., students add up sets of 4 two-digit numbers for 3 minutes). Results further confirm those of the original experiment they implemented: girls were considerably less likely to enter the competitive tournament than boys (-23%). Additionally, when considering the correlation between competitiveness and educational outcomes, tournament entry accounted for 18% of the gap between choosing the least and most prestigious track (compared to 15% for being female). In other words, the student's attitude towards competitiveness predicts their academic track choice slightly better than their gender. The authors conclude that gender differences in competitiveness explain 20% of the gender gap in academic choices.

Altogether, the results reported in this section emphasize the important role of competitiveness in choices, and how gender further impact those choices. High-ability women avoid entering competitions, even though they have good chances to win them; this inevitably leads to non-optimal pools of applicants, with significant loss of talents. Research therefore has begun to wonder whether and how high-performing women can be encouraged to enter competitions. As suggested by Niederle (2015), different choice architectures could mitigate gender differences, for instance by reducing the extent to which competitiveness mechanisms are activated (e.g., affirmative actions). Another possible determinant and, at the same time, solution concerns nurturing. Research suggests that preferences for competition and performances at competitive tasks are already gender-biased at an early age (Uri Gneezy and Rustichini 2004). By way of example, boys spend more time at competitive games than girls, and girls more often choose games with no clear end, no winner. Moreover, these differences exacerbate through puberty (M. Niederle 2015). Some researchers investigated whether such differences are related to social norms. For instance, Gneezy et al. (2008) studied two diametrically opposed societies, the Maasai of Tanzania (matrilineal society) and the Khasi of Northeast India (patriarchal society), finding that the gender gap in competitiveness

in the patriarchal society was similar to that of western societies. Interestingly, the gap was opposite in the matrilineal society, with women competing more than men. Other researchers have sought to replicate similar experiments and, among others, Andersen and colleagues (2013) compared the competitiveness of children aged 7-15. Their findings slightly differ from those of Gneezy et al. (2008), as there is no gender difference at any age in the matrilineal society, whereas females' competitiveness decline during adolescence in the patriarchal society. These and other findings suggest that attitude towards competition can be influenced by nurture, and thus women's lower competitiveness could be tackled directly at its source from a young age (Muriel Niederle and Vesterlund 2011).

Before implementing any possible solution, however, one should understand whether competitiveness is a desirable attribute. As pointed out by Niederle and Vesterlund (2011), being competitive may yield both advantages and disadvantages; for example, it could help climb the career ladder, but it could negatively affect outcomes of situations which require cooperation.

2.3.1.1 Competitiveness index

In the previous section we illustrated how researchers successfully measured competitiveness through experiments and how they then related it to several dimensions (gender, society, institutions) and outcomes (in education and performance). Despite those experiments yielded valuable results for research domain, the required costs and amount of time to implement them were not negligible. For these reasons, in our questionnaire we decided to opt for a psychometric tool which could reliably measure competitiveness by means of a self-report, the revised Competitiveness Index[31] by Houston and colleagues (2002) (see appendix). The index consists of 14 items with a 5-point Likert response type (from 1, not at all true, to 4, exactly true) and it assesses competitiveness as "a personality characteristic that influences behaviour across a wide variety of social domains, including work, sports, and interpersonal relationships" (J. M. Houston et al. 2005,

[31] The original Competitiveness Index was first designed as a 20-item true-false index and it was later modified into the Revised Competitiveness Index, since the authors thought that the true-false format may limit the measure's sensitivity to differences in competitiveness by restricting the variability of responses. For more information, Houston et al. (2004). "Revising the Competitiveness Index Using Factor Analysis." *Psychological Reports* 90(1): 31–34.

206). The items can be separated into two subscales: *Enjoyment of Competition* (9 items), which evaluates personal attitudes toward one's competitive behaviour, and *Contentiousness* (5 items), which examines attitude toward avoidant behaviour in arguments and conflicts. While the latter asks individuals to agree or disagree with statements such as "I enjoy competing against an opponent", the former refers to items such as "I try to avoid arguments".

Since the moment it was designed, the index aspired to be a personality trait measure, thus implying that competitiveness was a stable trait rather than a temporary one. Thus, in order to establish the validity of the index, Harris and Houston (2010) demonstrated its consistency over time (test-retest reliability), as well as its internal consistency (inter-item). The index has been used, among other things, to individuate differences between females and males, and to investigate the role of culture. Houston and colleagues (2005) observed competitiveness patterns in three cultures, namely among Japanese, Chinese and American undergraduate students. The choice of cultures was based on the individualism-collectivism duality, for which the researchers expected high competitiveness among American students and lower scores among Chinese and Japanese students. Their results can be summarized as it follows: first, American students scored higher on *Enjoyment of Competitiveness* than Chinese and Japanese students, but no difference was observed on *Contentiousness*; second, males scored higher than females on *Enjoyment of Competition* but not on *Contentiousness*. Their findings partially support experimental evidence from section 2.3.1, in the way that gender and culture affect attitude towards competition. However, not all aspects of the index appear to be influenced by these factors, since *Contentiousness* did not show significant differences among the analysed groups of students.

2.3.2 Risk and Time preferences

A fundamental principle of several theories of human behaviour is the influence of individual preferences on decision-making (Armin Falk et al. 2018). These include risk and time preferences, and economics is one of the disciplines which has produced a sizeable literature on the subject, particularly for risk attitudes. Even tough economists have attempted to investigate the possible causes and

consequences of these preferences, the literature cannot be considered as conclusive, since several questions are still open (M. Niederle 2015). A shared belief concerns the fact that risk preferences might heavily influence behaviour and choice, for instance, of the occupational path. In other words, people who are less prone to risk tend to choose occupations with more stable earnings, and these occupations, in turn, yield lower incomes on average (Bonin et al. 2006). The literature has also started to investigate the role of risk attitudes in explaining the gender pay gap, alongside more traditional possible explanations. Still, the relation between gender differences in preferences and in the labour market is among those unanswered questions (Blau and Kahn 2017). By way of comparison, gender differences in time preferences have been significantly less studied in economics, even though they appear to be driver of many economic decisions in which immediate utility may differ from delayed utility (Dittrich and Leipold 2014).

Focusing on risk, Niederle (2015) reviewed the existing literature both from psychology and economics, finding that the literature "seems to potentially suffer not only from a publication bias, but also the fact that many people seem to have a clear idea on what the 'correct' finding is" (M. Niederle 2015, 525). This observation derives from the heterogeneity in results, which in turn stems from the numerous elicitation methods adopted. Although overall results point to the existence of gender differences in risk aversion, some techniques yield a substantial gap, whereas others fail to do the same. The difficulties in drawing conclusions related to risk might be partially justified by its changeable nature; risk attitudes do not appear to be a stable individual trait. Consequently, it would be important to infer conclusions carefully, particularly when linking laboratory results to economic behaviour outside the lab (M. Niederle 2015).

Literature from psychology indicates that women are only slightly more risk averse than men. Indeed, gender differences were not detected in studies with small samples, and a meta-analysis conducted by Byrnes et al. (1999) revealed that while 60% of the effects supported women's risk aversion, 40% of the effects were negative (i.e., men were more risk averse than women) or null.

By the same token, the first economic experiment on the topic (Schubert et al. 1999) did not find striking differences between genders: of the four designed treatments, women had been more risk averse in one, more risk prone in another,

and insignificantly different from men in two treatments. Analogously, later studies failed to observe consistent gender gaps. Among others, Holt and Laury (2002) managed to find women's higher risk aversion only in experiments with small stakes (few dollars), whereas other lab experiments yielded gender differences in risk attitudes (e.g., Eckel and Grossman (2002)). As experimental economics increasingly became interested in such topics, several literature reviews were published. Early examples include Eckel and Grossman (2008) and Croson and Gneezy (2009), which reach slightly diverse conclusions. The former conclude that field studies provide evidence for greater women's risk aversion, but results from lab experiments are less compelling; the latter refers to the *robust* finding that men are more prone to risk than women. Another interesting line of research which focuses on risk attitudes among managers and professionals has failed to detect gender differences, thus the common idea that women dislike risk might not apply to this subpopulation (Atkinson, Baird, and Frye 2003; Dwyer, Gilkeson, and List 2002). Further research could try to understand whether this phenomenon is the result of selection (i.e., risk prone women and men choose to be managers) or learning (people learn from their professional environment).

As pointed out earlier in this section, different conclusions might derive from several reasons, such as the malleable nature of risk attitudes, the sample size, and the various methods used to measure risk preferences. Indeed, different tools assess different aspects of risk preferences, thus any observed gender difference depends on the way in which attitude towards risk is measured. Furthermore, Croson and Gneezy (2009) identify some factors which might contribute to them. Firstly, women and men emotionally react to uncertainty in a different way; secondly, men are more self-confident than women; finally, while women tend to view risky situations as threats, men consider them as challenges.

A first step to overcome the pitfall of different elicitation methods is the study conducted by Charness and Gneezy (2012). The authors summarize 14 papers which used the same risk measure, an investment game originally designed by Gneezy and Potters (1997): individuals receive a fixed amount of money X and can decide to invest any part x of X in an investment. The investment yields dividends of kx with probability p and nothing otherwise. They find that in 13 out of the 14 papers analysed women choose a lower x than men, that is, women invest less than

men. This finding leads them to conclude that women are financially more risk averse than men, but results do not provide sufficient evidence to claim women's lower risk attitude in general.

One of the most difficult research questions is assessing whether gender differences in risk can impact life outcomes in a significant way. A paper analysed in section 2.3.1 (T. Buser, Niederle, and Oosterbeek 2014) measured risk attitudes among children with two tools, lottery and a non-incentivized risk question, i.e., "How do you see yourself: Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?''. The purpose of the researchers was to understand whether education choices were correlated with risk preferences; they found that only the lottery measure accounted for a fraction of the gender differences in education choices, whereas the non-incentivized risk question was not correlated. Apart from few examples of studies which, however, cannot be considered as conclusive, the literature on the topic needs to be expanded.

With regard to time preference, the existing economic literature is substantially more modest in size. Nevertheless, one should not think of it as less important than risk. People take a host of decisions that require balancing costs and benefits at different points in time, for instance, going to university, learning a new language, planning savings (Golsteyn, Grönqvist, and Lindahl 2014). Intertemporal decision making has been at the centre of human capital theory, with the idea that people who have lower discount rates (more patience) invest more in their future (Mincer 1958). Some studies have sought to estimate gender differences in time preferences; for instance (Dittrich and Leipold 2014) concluded that German women are more patient than German men. Others have advanced their questions to whether attitude to time could explain life outcomes. Specifically, Golsteyn and colleagues (2014) focused on Swedish children aged 13 and followed them up in adulthood for fifty years. They find a negative relationship between impatience and life outcomes, such as educational attainment or employment (i.e., impatient individuals achieve less at school and spend more days in unemployment). Moreover, while women appeared to be more patient than men, men benefited more from patience than women.

A large extent of time preferences studies, included those above, have used samples which cannot be representative of the general population. Moreover, as previously stated, the cited literature on risk preferences leaves many questions

unanswered (e.g., whether it exists the production bias hypothesized by Niederle (2015)). The extensive survey conducted by Falk and colleagues (2018) can not only help us disentangle some hot debated issues, but it can provide new perspectives on differences in preferences. Their Global Preferences Survey involved 80,000 people from 76 countries, which represented 90% of the world population. The survey items were selected from a previous study (see section 2.3.2.1 for details) and they yielded interesting results both on a global and individual level.

On a global level, risk and time preferences are spatially and culturally concentrated. For instance, the most patient countries worldwide are either located in the English-speaking world, or in Western Europe, with the latter being also notably risk averse. Nonetheless, it might be surprising that within-country differences are even greater. This phenomenon calls for an investigation at an individual level; data allow a further distinction between OECD and non-OECD countries but, for the reasons provided at the outset of this thesis, we will focus our analysis on OECD countries. The authors explore whether individual characteristics (i.e., gender, age and cognitive abilities) are related to preferences. With regard to risk preferences, their findings are in line with several previous studies: women are more risk averse. Additionally, risk aversion is more pronounced among individuals with low cognitive abilities, whereas risk tolerance decreases with age. Focusing on time preferences, the authors find that the gender gap in patience demonstrated in previous studies is null or reversed (i.e., women are either as patient as men or slightly less patient than men); however, the phenomenon is considerably heterogeneous across countries. Moreover, individuals with high cognitive abilities are more patient, and the relationship between age and time preferences is hump-shaped: individuals in middle adulthood are the most patient.

To conclude, some trends in preferences are universal, but some other relationships substantially differ across countries, such as the one between patience and gender. Such discrepancies are likely related to cultural and geographic conditions.

2.3.2.1 Risk and time preferences survey

From the literature review it emerges that incentivized experiments are the most widely used tools to measure preferences, especially in economic research. Their advantages are, for instance, the observation of actual behaviour and the control of the experimenter. However, these elicitation methods are not exempt from disadvantages; to mention but few, they are expensive and time consuming.

The measure we chose to include in our questionnaire is an experimentally validated survey module which is able to assess preferences in large samples in a cost-effective way (A. Falk et al. 2016). We used the Italian version of the survey provided by the authors on the related website (www.global-preferences.org) (see appendix). The core of its reliability lies in the choice of the best elicitation methods used to observe behaviour in incentivized experiments. In this way, the survey not only rules out the possible pitfalls related to hypothetical situations, but also selects the best predictors of behaviour[32].

Risk preferences are measured through two survey items. One is the qualitative item, that is, a question asking about an orientation in risk dimension on a scale from 0 to 10: "In general, how willing are you to take risks?". The other item is quantitative and it represents a hypothetical version of the experiment itself. Specifically, risk is measured with a series of five interdependent hypothetical binary choices between a fixed lottery, in which the individual can win x or zero, and varying sure payments (a format commonly known as the "staircase" or "unfolding brackets" procedure (Cornsweet 1962)). Time preferences are measured only through the quantitative item[33]. By the same token, participants needed to make a series of five binary choices between immediate and delayed financial rewards; they were required to decide between receiving a payment today or larger payments in 12 months in each of the five questions. The quantitative item is usually the most accurate predictor of behaviour for time preferences.

[32] For instance, the survey items about risk preference predicted behaviour in incentivized experiments in 30 different countries (for more information, Vieider et al., 2015). This suggests that the elicitation measures selected for the survey predict behaviour in representative and cross-cultural samples.

[33] In the survey conducted by Falk et al. (2016), time preference is measured by both a quantitative item and a qualitative item, but in our questionnaire the qualitative item was not included. For completeness, we report weights for calculating time preference score: 0.7115185 (staircase); 0.2884815 (scale). As noted by Falk and colleagues, the quantitative item is the best predictor of behaviour. For risk, instead, weights are more similar: 0.4729985 (staircase); 0.5270015 (scale).

2.3.3 Self-efficacy and fear of failure

The investigation on the role of self-efficacy in the underrepresentation of women in STEM begins with a review of the seminal contribution made by Bandura (1977; 1992; 1994; 1997). In his studies, Bandura illustrates the theory of behavioural change for self-efficacy, which is defined as "people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives" (Bandura 1994, 71). According to theory, self-efficacy impacts the way a person feel, think and act through four major processes: *cognitive, motivational, affective* and *selection* process (Bandura 1997). With regard to feeling, the perception of self-efficacy influences the level of stress and depression, as well as motivation. People with low self-efficacy experience these negative feelings more than others in the face of pressing situational demands and are less motivated. By contrast, an efficacious outlook reduces stress and vulnerability to depression. In terms of thinking, high self-efficacy facilitates cognitive processes (e.g., analytical thinking) in various situations, leading to better decisions and personal accomplishments. Finally, people's prospective actions are forethought in their mind and their level of self-efficacy anticipates either optimistic or pessimistic outcomes, hence affecting motivation. Beliefs about what people can do shape their motivation and guide their actions. People with high self-efficacy choose to perform challenging tasks, considering them as challenges rather than threats; they set ambitious goals and put all their effort to achieve them. Moreover, if failures or setbacks occur, they attribute them to insufficient effort or inadequate knowledge which is acquirable, thus their perception of self-efficacy is quickly recovered. By contrast, low self-efficacy leads to focus on personal deficiencies and adversities, low aspirations and level of engagement. Consequently, their level of self-efficacy is slowly restored after failures.

Given the numerous benefits of high self-efficacy on human accomplishment and personal well-being, the next step in our analysis is understanding how to develop an efficacious outlook. Bandura (1994) lists four main sources of self-efficacy[37], one of which is regarded as more effective than the others: *mastery experience*, or in other words personal accomplishment. Success is the main contributor to a strong

[37] The order in which the four sources of self-efficacy are presented does not reflect an order of importance.

belief in one's personal efficacy, whereas failures undermine it, especially if experienced early in the development of self-efficacy. However, as people become gradually aware of their potential, they emerge from adversities and persist towards their goals.

The second source of self-efficacy is *vicarious experience*, provided by social models. When an individual sees a person considered a model succeeding in a difficult situation, the social comparison leads the individual to believe that he/she can master the situation as well. The impact of vicarious experience on self-efficacy heavily relies on the perceived similarity to the models: the more an individual perceives similarity, the greater the impact of the models' successes and failures on self-efficacy. Social models can contribute to the development of self-efficacy not only by providing a social standard for other individuals to measures their capabilities, but also by conveying their knowledge. In fact, people choose their models on the basis of the skills they want to acquire, thus an efficient social model teaches through his/her actions how to master a situation.

The third source of self-efficacy is *social persuasion*, since when people are persuaded verbally that they have the knowledge and skills to master situations, they are likely to put greater effort to succeed. Another relevant characteristic of good persuaders is the way they measure success, namely in terms of self-improvement rather than by victory over others. It should be noted that persuasion might more likely result in an erosion of self-efficacy rather than an improvement, because in case of unrealistic persuasion (i.e., an excessive boost in efficacy) people quickly learn the truth from disappointing results and ultimately have lower self-efficacy than prior to the persuasive action.

The fourth and last source of self-efficacy is *emotional arousal*, which concerns people's beliefs in their ability to cope with difficult situations. Specifically, people experience different levels of stress when an adverse situation occurs, but what is important is the way they interpret it: high self-efficacy individuals view their emotional arousal as an energizer, whereas low self-efficacy people consider it as a debilitating factor.

Self-efficacy is not a fixed trait. Throughout the course of the lifespan, it develops and adapts to new demands (Bandura 1994). Starting from childhood, the initial efficacy experiences are centred in the family, with parents who create

opportunities to act efficaciously (e.g., exploring spaces and learning a language). Later on, peer relations and social comparison become increasingly important, first with siblings and then with classmates. Families differ in a host of factors (for example, in number of siblings, in their birth order and in their sex distribution), therefore different family structures create different social comparisons, ultimately affecting the development of self-efficacy. Alongside, children tend to choose peers with similar interests and values and they mutually develop self-efficacy. Moving on, school is the place where children acquire cognitive competencies and, at the same time, grow the self-knowledge of their capabilities. Students' beliefs shape their interests, aspirations and accomplishments throughout school years and influence, among others, the competencies they cultivate and the vocational paths they choose. The relevance of self-efficacy beliefs is most clearly revealed when individuals approach early adulthood. Career choice and development is a prominent example of decision made in this period of life, although the career choice process occurs throughout the life cycle with individuals making several decisions that have implications on occupational directions (Correll 2001). Bandura's theory (1992) suggests that the higher the level of self-efficacy, the wider the range of career options people consider and the greater the interest they show in them. Moreover, self-efficient individuals better plan their education for the occupational pursuits they choose, thus they are more likely to be successful at them. Once in the labour market, self-efficacy continues to be helpful in dealing with problem-solving, job displacements and career changes.

Theory and research on the influence of self-efficacy over life paths are well documented. Alongside, it is also acknowledged that "[h]uman differentiation on the basis of gender is a fundamental phenomenon that affects virtually every aspect of people's daily lives" (Bussey and Bandura 1999, 676). The Social Cognitive Theory of Gender Development and Differentiation by Bussey and Bandura (1999) explains how gender concepts develop from life experiences and interrelate with motivation and self-regulatory mechanisms.

Females' beliefs about their capabilities largely depend on gendered social practices implemented in several contexts: within the family, the educational system, peer relationships, the mass media, the occupational system, and the culture at large. Over time, researchers have been investigating the causes of the dearth of

women in STEM and the majority of studies suggest a linkage to mathematics. With respect to family, studies (Eccles 1989; Frome and Eccles 1998) reported that parents generally follow the stereotype that boys are innately better equipped with quantitative skills than girls, despite equal achievement in mathematics. In doing so, parents underestimate daughters' math abilities, conveying the message that math is a difficult subject for them and should they succeed, it would be the result of hard work, rather than a good attitude to mathematics. The sum of these actions ultimately results in discouraging females from studying quantitative subjects.

School is another major environment where pupils further absorb gender stereotypes. For instance, teachers reproach children when they engage in activities considered inappropriate for their gender and impose different social sanctions for boys and girls. Specifically, teachers tend to congratulate with boys on their academic achievements and condemn their misbehaviour, whereas they prioritize girls' tidiness and criticize their academic failures (Bussey and Bandura 1999). The different nature of social sanctions appears to boost the perceived self-efficacy of boys but weaken that of girls, with repercussions on personal accomplishments and well-being illustrated by the theory of behavioural change for self-efficacy (Bandura 1977; 1992; 1994; 1997). The impact of teachers in children's development, however, is not limited to imposing social sanctions. Teachers' beliefs and stereotypes heavily influence both math performance and high school track choice. Female students assigned to teachers with stronger "math-males" implicit association (measured by the Implicit Association Test) appear to experience gender inequality in several ways, from having lower expectations to underperforming in typically male domains. Empirical results are cause for concern, as one third of the gender gap in math performance created during middle school can be explained by teacher implicit stereotypes; moreover, biased teachers induce more girls to attend less demanding high-schools (Carlana 2019). These results are in line with the theory that categorizing a group (in this case, females) as less able in math leads to underperformance in math – a phenomenon often referred to as *Golem effect*[38].

[38] For more information on self-expectancy effects and self-fulfilling prophecies, see Bertrand, M., Duflo, E. (2017) "Field Experiments on Discrimination". In Handbook of Economic Field Experiments, Elsevier 309–393.

Other studies, however, found that the gender gap in math self-perception of competence decreases over time (from 1st to 12th grades) (Fredricks and Eccles 2002; Jacobs et al. 2002). The trend was explained by a faster decrease of males' math self-efficacy, if compared to that of girls: at 1st grade male students believed they had better abilities in mathematics than girls, but over the years their math self-efficacy declined faster than that of girls, and by the end of high school girls and boys had similar beliefs of their math competence. Moreover, the most dramatic changes in self-perception for both female and male students happened during elementary school. Taken together, these findings contradict gender socialization theories (Eccles 1987), and gender intensification theories (Hill and Lynch 1983), which are based on the idea that the gender gap increases with age, respectively because of the persistent exposure of individuals to family, teachers, peers and media gendered norms, and because of gender intensification during adolescence that may push boys and girls into being interested in gender appropriate activities.

Performance in mathematics is influenced by gender indirectly, i.e., perceived mathematical self-efficacy mediates and predicts performance (Pajares and Miller 1994). As confirmed by an extensive literature, simply stating a gender stereotype (in our case, women's lower mathematical skills) is detrimental to women's perceived efficacy in math and creates anxiety, ultimately undermining their performance. The phenomenon is extensively referred to as *stereotype threat* (Steele 1997; Spencer, Steele, and Quinn 1999). It is not necessary to personally endorse gendered beliefs for biased outcomes to happen; if the individual internalize that "most people" believe boys are better at mathematics, this would be sufficient for both males and females to unconsciously expect better task performances from men. Whether females endorse stereotypical beliefs or not, the predicted outcome is the same: females will underestimate their own mathematical ability, due to low self-efficacy levels.

The channelling of interests into different academic domains largely affects career trajectories. Stereotypic occupational orientations are intertwined with self-efficacy beliefs: boys judge themselves more efficacious for careers in STEM, whereas girls have a higher sense of efficacy for social, educational, and health service (Bandura 2006a). Moreover, women base their occupational choices even more heavily on their perceived efficacy than on the potential benefits of vocations

(Bussey and Bandura 1999). Low mathematical self-efficacy is a grave obstacle to a wide range of occupational fields that require quantitative skills. The underrepresentation of women in STEM mostly relies on discouragement to pursue quantitative and scientific careers, rather than actual inability. Nonetheless, self-disbeliefs can be weakened and sense of mathematical self-efficacy can be heightened, especially through mastery experience (Bussey and Bandura 1999). Given that career aspirations become crystallized early in children's developmental process, interventions to mitigate stereotypes and gender biases should be implemented at the earliest phases.

Latest PISA results (for the year 2018) further confirm that there is no intrinsic or innate difference between genders in mathematical or scientific skills (for more details, see Box 1). However, equality in girls' and boys' cognitive abilities is not sufficient to close the gender gap in STEM. The sharpest differences between boys and girls are only unveiled when students express their feelings about their own abilities. Latest PISA results and other studies (Bussey and Bandura 1999; Correll 2001; Williams and George-Jackson 2014; OECD 2015) found that girls have less belief in their own abilities in mathematics and science, and suffer from greater anxiety towards mathematics than boys, even in case of equal performance. Interestingly, the relationship between the index of self-efficacy and performance was almost equivalent among boys and girls: test scores always rose between six and seven points for every one-unit increase in the index of self-efficacy (OECD 2019d). The power of the social and emotional dimensions of learning should not be underestimated, as they may indeed guide ambition even more heavily than performance.

Another trait which revealed significant gender differences in PISA assessment is fear of failure. Fear of failure can be considered as the other side of self-efficacy, since students who believe they are uncapable of performing properly in certain circumstances are more likely to fear or avoid such circumstances. The majority of PISA students (56% in OECD countries, 57% in Italy) agreed or strongly agreed that when they fail, they worry about what others think of them. In almost every education system (including the Italian one), girls have greater fear of failure than boys and, on average across OECD countries, the gender gap in the index of fear of failure was the largest of all the indicators assessed in PISA. Additionally, the divide

was considerably greater among top-performing students (OECD 2019d).

Furthermore, data provide evidence for another behavioural mechanism operating differently on the basis of gender. Specifically, moderate fear may stimulate students to commit to academic tasks: girls who expressed greater fear of failure had higher mathematics and science scores than girls who reported less fear of failure (respectively, differences of five and eight points per one-unit increase in the index of fear of failure). Simultaneously, boys who expressed a greater fear of failure scored only marginally higher in the above subjects than boys who expressed less fear of failure (a difference of one point in mathematics and two points in science). In other words, the positive impact of fear of failure on performance is more powerful on female students and is a better predictor of their academic performance. In fact, boys with greater fear of failure scored lower than those with low fear of failure in 21 countries, whereas the same occurred for girls in only 5 countries (OECD 2019d).

Success and failure are inextricably linked with competitiveness. The psychology literature (Dweck et al. 1978) indicates how males and females differently react to success and failure, with the main pattern being that males tend to attribute success to internal factors (e.g., talent) and failure to external factors (e.g., luck), whereas females think exactly the opposite. The different approaches impact the willingness to compete, which is a relevant trait especially for people who want to pursue higher education and qualified job positions. Empirical data show how success and failure in competitive settings can influence subsequent choices in a way that success leads to further success and failure leads to further failure (Thomas Buser 2016). Gender appears to be an important dimension also when analysing the reaction to failure; particularly, when women fail in a competition, they are significantly less likely to enter it again (Thomas Buser and Yuan 2019) and they lower their performance, possibly as a consequence of less effort (Thomas Buser 2016). It appears that failure, especially at the first stages of a career or at relevant school competitions, is detrimental to high-performing women, with long-term negative consequences on life outcomes.

2.3.3.1 General Self-Efficacy Scale and Raven's Progressive Matrices

Self-efficacy is commonly interpreted as a situation-specific psychological trait. In Bandura's words, "the efficacy belief system is not a global trait but a differentiated set of self-beliefs linked to distinct realms of functioning" (Bandura 2006b, 307). Thus, in his view, the level of self-efficacy largely depends on the circumstances and domains in which it is studied. An all-purpose measure of perceived self-efficacy would have limited reliability, since some or most of the items in an all-purpose test may be irrelevant to the specific situation. Nonetheless, he recognizes that a multidomain measure can provide an overview on people's general sense of efficacy.

In an attempt to develop a scale which could measure self-efficacy at a more general level of functioning, Schwarzer and Jerusalem (1995) presented the General Self-Efficacy scale (GSE)[39], whose purpose is to assess the global sense of personal competence in handling a host of stressful or challenging situations. Since then, the scale has been translated into 32 languages to date and its stability over time has been established in several longitudinal studies (Ralf Schwarzer and Schröder 1997; Ralf Schwarzer, Hahn, and Jerusalem 1993; Schröder, Schwarzer, and Konertz 1998). GSE psychometric properties are further confirmed by its positive correlations with self-esteem and optimism, and negative correlation with anxiety and depression (Luszczynska, Gutiérrez-Doña, and Schwarzer 2005; Luszczynska, Scholz, and Schwarzer 2005; Ralf Schwarzer et al. 1997; Scholz et al. 2002). Furthermore, its validity as a universal construct has been vastly assessed in cross-cultural studies (Ralf Schwarzer et al. 1997; Scholz et al. 2002; Luszczynska, Scholz, and Schwarzer 2005; Luszczynska, Gutiérrez-Doña, and Schwarzer 2005).

In order to ascertain the universality of the GSE, adaptations to other languages need to be accurate and should be more than mere literal translations. In fact, a correct translation of the GSE requires a cultural adaptation of the instrument, and the bilingual native speakers involved in the process acquire a thorough understanding of the GSE construct. For the purpose of our study, we used the Italian version of the GSE (Sibilia, Schwarzer, and Jerusalem 1997), which can be found in

[39] The original version of the General Self-Efficacy scale was created in 1979 by Schwarzer and Jerusalem. The scale was developed in German and included 20 items; in 1981, items were reduced to 10 and it was later adapted to several languages (Scholz et al. 2002).

the appendix. As every other version, it has 10 items with a response range based on the Likert-type scale, namely, from 1 (not at all true) to 4 (exactly true). An additional study which supports our choice is the one conducted by Schwarzer et al. (1999), through which they validated the assessment of GSE on the internet. The authors compared data collected on the internet with data collected through written tests and found homogeneous results. Psychometric properties of the GSE scale were not impaired by the different tool of assessment and the comparability between the online sample and the traditional sample was solid.

With regard to gender, researchers have attempted to find differences between males and females in GSE assessment, reporting inconsistent findings. For instance, Schwarzer et al. (1999) observed that, on average, men had a higher general self-efficacy level than women. A similar result was achieved in another study (Ralf Schwarzer et al. 1997) which compared German, Chinese and Costa Rican samples: a stronger sense of perceived general self-efficacy was assessed among males in China and Germany, but not in Costa Rica. Another study (Scholz et al. 2002) which investigated the construct in 25 countries reported slightly lower GSE levels of women, but the interaction between nation and gender revealed that the effect was unsystematic. Therefore, differences in cultural settings may influence GSE results.

Gender discrepancies in general perceived self-efficacy are not universal and although some studies have been conducted, the reasons behind unsystematic differences are still insufficiently explored.

Our questionnaire aimed at measuring self-efficacy both directly, with the GSE, and indirectly, with the relative ability to solve Raven's Progressive Matrices (RPM). The RPM is a common test used in educational settings as a non-verbal estimate of fluid intelligence and is designed to measure abstract reasoning (Raven 1936). Students were first asked to answer to the RPM by identifying the missing element that completes a pattern (the 9 test items were listed in order of difficulty[40]). Secondly, students were asked questions on their absolute and relative performance, e.g., how many of the problems they thought they correctly solved,

[40] The original version of the test includes 60 items. Researchers later worked to develop a test with equal predictive power, but with a reduced number of items necessary to correctly measure abstract reasoning. The result is an abbreviated nine-items version of the RPM. For more information, Bilker et al. (2012). "Development of Abbreviated Nine-Item Forms of the Raven's Standard Progressive Matrices Test", *Assessment* 19 (3), 354-369.

how they ranked in their class, how sure they were of their responses (for further details, see the appendix). In this way, we intended to have for each student an objective cognitive measure, the RPM, and a subjective measure of relative self-efficacy.

2.3.4 Self-control[41]

Self-control is thought to be one of the most powerful and beneficial adaptations of the human psyche (Tangney, Baumeister, and Boone 2004). Self-control is "the ability to alter one's thoughts, emotions, and behaviors, or to override impulses and habits" (Maranges and Baumeister 2016, 42). By controlling the self, individuals can meet their expectations and standards, which are imposed either by society or oneself, e.g., rules, plans, promises and ideals. Alternative definitions focus on the capacity to change and adapt the self to produce a more optimal fit between the self and the world. More specifically, "[p]eople attempt to gain control not only by bringing the environment into line with their wishes (*primary* control) but also by bringing themselves into line with environmental forces (*secondary* control)" (Rothbaum, Weisz, and Snyder 1982, 5). Although the process of self-control might appear reasonable, its implementation in real life is more complicated. Most personal and social difficulties in everyday life, in fact, appear to be linked to an inadequate regulation of the self. Examples include alcohol and drug consumption, eating disorders, criminality, financial problems and underachievement (Baumeister, Heatherton, and Tice 1994; Baumeister, Schmeichel, and Vohs 2007).

In order to understand what lies behind the failure of self-control, it would be appropriate to analyse the concept from a theoretical perspective. The three basic elements of self-control are: (a) commitment to standards (b) monitoring of the self (c) actions needed to alter the self's responses. All of them are equally important to exert self-control, thus a problem in a single component might result in a failure of the mechanism (Baumeister, Schmeichel, and Vohs 2007). Particularly, since the essence of self-control is a change of the self, it would be pointless to proceed without a conception of the ideal self; the motivation to commit to standards is key

[41] For the purpose of this study, self-control and self-regulation are interchangeable, although psychologists treat them as slightly different concepts. For more information, Vohs, Kathleen D., Baumeister, Roy F. *Handbook of self-regulation: research, theory, and applications*. New York: The Guilford Press, 2018.

in the process of self-control. Moreover, monitoring a behaviour is fundamental to alter it when necessary; to modify such behaviour, however, the individual must be aware of the alteration he desires and, in this regard, the link between self-awareness and self-regulation theorized by Carver and Scheier (1981) was a major breakthrough in explaining the whole self-regulation process. The last component of self-regulation, that is, the action aimed at making changes of the self, is based on the *strength model,* which explains that self-regulatory activities consume a limited resource that resembles energy or strength. The same resource is used for a host of different situations in which self-control is needed and, once a share of that resource has been employed, subsequent self-regulation operations will likely be impaired, even in apparently unrelated areas. The reason behind the impairment is the reduction (even only temporary) of the resource, to whom researchers refer as *ego depletion*. Despite exerting self-control leads to a short-term reduction of the individual's capacity to control other actions, in the long run the individual can increase such capacity by resting or exercising (Baumeister, Schmeichel, and Vohs 2007).

Several studies provide evidence of the benefits of self-control[42]. Among others, Mischel and Ayduk (2004) demonstrated in an extensive research how a delay in gratification predicts long-term benefits. Resisting to the impulse for an immediate gratification in exchange for a greater but delayed reward requires a large amount of self-control. On this concept, the authors tested children aged four and followed them up through adulthood to observe any relation between their behaviour in childhood and their lives as adults. Results concluded that those children who were able to resist the impulse for immediate gratification (i.e., waiting an extended amount of time to eat two cookies, rather than having one cookie immediately) reported higher Scholastic Aptitude Test (SAT) scores and had better social-cognitive, personal and interpersonal competencies.

Another study (Tangney, Baumeister, and Boone 2004) found that people with high self-control featured a variety of positive outcomes: they had better grades,

[42] Although research only provide information about correlations – that is, in principle it is possible that self-control is the result rather than the cause of any behaviour – most theorists assume that personality traits precede behaviours. Thus, self-control is more likely to be the cause rather than the consequence of any behaviour (Baumeister, Schmeichel, and Vohs 2007).

higher self-esteem and better interpersonal relationships (e.g., family cohesion, less anger and a better anger management if they get angry); moreover, they were less susceptible to eating disorders and alcohol abuse. Other researchers which adopted the same tool of assessment confirmed the results of Tangney et al. (2004). Specifically, people with higher self-control reported more satisfying relationships, due to interpersonal accommodation (i.e., the willingness to inhibit impulses which damage relationships and, instead, act constructively) (Finkel and Campbell 2001). High self-control was also associated with less delinquency and aggression among adolescents (Finkenauer, Engels, and Baumeister 2005).

Some theories have advanced the hypothesis that high levels of self-control contribute to behavioural and psychological problems, such as obsession and compulsion. However, researchers tend to reject this view, arguing that "overcontrolled" individuals suffer from an ineffective regulation of their ability to self-control or, in other words, they are not able to suspend self-control when it is not required. By contrast, people with a genuine high level of self-control understand when it is appropriate to activate or deactivate their self-control mechanism. Thus, they regulate themselves in response to what the context demands.

Focusing on gender patterns, theories of self-control have mainly focused on crime and, as previously stated, good levels of self-control reduce the risk of delinquency (Finkenauer, Engels, and Baumeister 2005). In the general theory of crime by Gottfredson and Hirschi (1990) the authors argue that gender differences in crime rates, i.e., males being more apt to commit crimes, stem from differences in levels of self-control. In their view, a crucial factor in developing good self-control is adequate parenting; however, boys' misbehaviour is less monitored, recognized, and corrected by parents than girls' misbehaviour. This difference in parenting contributes to a better development of self-control for girls and subsequent lower likelihood of misconduct.

However, the central role of parenting predicated by the theory might lead to overlooking other social factors which could impact the developmental path of self-control, such as teachers, peers, and community environments. These elements have proved to assume a relevant role in boosting other non-cognitive factors, e.g., self-efficacy, and research suggests that they might play a similar role in the

development of self-control. Among others, Burt et al. (2006) indicated that association with different types of peers (diligent peers vs. misconducting peers) and attachments to teachers significantly affected self-control patterns, even after controlling for parenting. Other similar findings suggested that, in spite of the prominent role exerted by parents on the level of self-control, peer affiliation and attachment to teachers were relevant factors for both genders (Jo and Bouffard 2014). More specifically, teachers and peers had the same influence on self-control for girls, whereas the effects of peer affiliation were greater than teacher attachment for boys. Researchers have advanced the hypothesis that the source of self-control changes over time. Children aged 10 might be mainly influenced by parents, as theorized by Gottfredson and Hirschi (1990); however, as children grow up, they spend an increasing amount of time at school and both teachers and peers might substitute the role of parents in self-control development. Another assumption of the theory states that gender differences in self-control are established in early stages of life (8-10 years old) and they persist throughout life. Several studies, however, contradict this theory. For instance, Jo and Bouffard (2014) found that males had significantly lower self-control than females while being 10-12 years old, but the gender gap steadily decreased until it became non-significant among 13-14 years old individuals.

In summary, while individuals might follow diverse developmental path of self-control, this psychological trait is a relevant factor in human quality of life which generates beneficial patterns, both to the individual and to others who surround him.

2.3.4.1 Self-Control Scale

The investigation of the possible positive outcomes of self-control benefited from a good trait measure of the construct provided by Tangney et al. (2004), which can be found in the appendix. The Brief Self-Control Scale (SCS) [43] is the tool of assessment we included in our questionnaire, given its adequate internal and test-retest reliability. The scale focuses on the actions through which the individual

[43] The Total Self-Control Scale comprises 36 items. Both Brief and Total scales showed adequate internal and test-retest reliability. For more information, Tangney, J. P. et al. (2004). "High self-control predicts good adjustment, less pathology, better grades, and interpersonal success." *Journal of Personality* 72(2): 271-324.

overcomes its impulses, for instance, breaking habits, resisting temptation, and maintaining good self-discipline. It comprises 13 items with a response range on a 5-point scale, from 1 (not at all like me) to 5 (very much like me). These items cover all the spheres of self-control encompassed in the extensive review of studies by Baumeister et al. (1994), namely control over thoughts, emotional control, impulse control, performance regulation, and habit breaking.

The SCS was subject to be critiqued for the potential influence of the social desirability bias, i.e., people falsely claiming to have good self-control because they wish to look good and conform to socially approved norms. Scores on social desirability correlated significantly with scores on the SCS, but controlling for social desirability biases hardly affected most of the links between self-control and other outcomes. In other words, the effects of self-control on the various outcomes were more robust than those of social desirability. A further potential limit of the SCS was its self-report nature. However, investigations which used objective measures of academic achievements (e.g., university registrar) replicated the finding that high self-control predicts better grades. Taken together, these results point towards the objective validity of the benefits of self-control and of the SCS elaborated by Tangney et al. (2004).

2.3.5 Self-esteem

Self-esteem is arguably one of the most studied constructs in the modern social sciences. In this section, the analysis of the concept will lay its foundation on the extensive review of the literature conducted by Baumeister and colleagues (2003). Their research purpose was to understand whether high self-esteem was as important in one's life as many people thought. Particularly, they wanted to learn whether self-esteem was the cause of life's successes and failures. People experience the greatest changes in self-esteem concomitantly with major successes and failures – e.g., achieving an academic or professional result, or losing a contest – and they tend to draw a parallel between boosts and losses of self-esteem and those events. This link leads people to intuitively believe that self-esteem is a relevant factor in life. However, the correlation between an event and a variation of self-esteem, if any, does not indicate the direction of causality. In other words, if high self-esteem correlates with, for instance, good performance at school, we cannot establish from

this piece of information if self-esteem causes a good performance, or the contrary is true, or both outcomes stem from another factor, such as the socioeconomic status. For this reason, the authors thoroughly reviewed empirical findings to determine whether high self-esteem is a cause of positive and negative outcomes as many people think.

Self-esteem is defined by "how much value people place on themselves" (Baumeister et al. 2003, 2). Consequently, people with high self-esteem evaluate themselves in a highly positive way, whereas low self-esteem implies an unfavourable evaluation of the self. These definitions highlight the subjective nature of the concept. Self-esteem refers to a perception rather than a reality, thus, the evaluation may be accurate and balanced or distorted in both directions (namely for an arrogant superiority or an unjustified sense of inferiority). After having established that self-esteem is a perception, research then must focus on demonstrating that people's beliefs about themselves play a key role in life, without regard to what is the reality behind self-evaluations.

The thorough review of the literature conducted by Baumeister and colleagues (2003) revealed that self-esteem was highly correlated with several life outcomes[44], even though establishing the direction of causality was not easy in many cases. In spite of this limitation, the findings are worth of consideration.

The impact of self-esteem on school performance has been more investigated than any other outcome. The sizeable literature, however, did not provide enough evidence to conclude that high self-esteem strongly improves academic performance. Rather, the reverse may be true, i.e., high self-esteem could be the result of good performance at school – even this tendency, however, is weakly supported by data. Therefore, other variables could influence both self-esteem and school performance.

Focusing on job performance, the major finding is that high self-esteem leads people to persist in the face of failure. Additionally, high self-esteem people choose more than others their own strategies and they understand more easily when it is the case to stop persisting and changing strategy. Thus, they regulate themselves

[44] References for each of the topics illustrated in this section are available in Baumeister, R. F., Campbell J. D., Krueger, J.I., and Vohs, K. D. "Does High Self-Esteem Cause Better Performance, Interpersonal Success, Happiness, or Healthier Lifestyles?" *Psychological Science in the Public Interest* 4, no. 1 (May 2003): 1–44.

better in professional choices. Other than these findings, research points to the direction that occupational success leads to high self-esteem, but the authors believe that a more systematic investigation is needed.

When it comes to interpersonal relationships, a common idea is that before loving others you must love yourself. One can draw two implications from this statement: firstly, self-esteem is essential in relationships, and secondly, self-esteem is the prerequisite for good relationships. Clearly, people attribute a high value to self-esteem in explaining good and bad interpersonal relations, but the authors' investigation of empirical findings revealed relatively little about the direction of causality. Moreover, high self-esteem produces both advantages and disadvantages. The most promising results concern social initiative: people with high self-esteem have more tendency to initiate interpersonal contacts and relationships. Although people high in self-esteem believe that they are better liked by others, evidence disconfirmed this belief and, in some cases, they were even more disliked than others. In group, people with high self-esteem sometimes perform better by speaking up and proposing actions, and their contributions are well-evaluated by teammates. Correlations between self-esteem and leadership, however, are weak.

Baumeister and colleagues indicate that most studies have failed at establishing a conclusive relation between self-esteem and antisocial behaviours (aggression, delinquency and violence). At most, they sense that high self-esteem intensifies both prosocial and antisocial behaviours: some subcategories of high self-esteem (e.g., narcissism or defensiveness) are related to an escalation of violence or bullying, whereas other categories of high self-esteem predicts defending victims against bullies. At the other end of the continuum, there is some evidence that low self-esteem leads to delinquency, but the findings are not conclusive.

When it comes to health, results are multifaceted. The most promising finding is that high self-esteem likely prevents eating disorders[45], especially bulimia, and there is some proof for a link to longevity. Additionally, some positive findings support the hypothesis that high self-esteem helps people coping with stressful situations and failure, whereas it is more difficult to draw conclusions for the role of

[45] Baumeister et al. (2003) point out that other disorders related to self-esteem, such as depression and anxiety, might contribute to eating disorder symptoms. Thus, conclusions shall be drawn with caution.

low self-esteem (some studies found that it increased vulnerability to stress but was irrelevant in good times, other studies found the opposite). As much as smoking, alcohol and drugs are concerned, data did not show a relation to self-esteem; if anything, young people with high self-esteem may be more inclined to experiment.

Lastly, the most robust correlation was found for high self-esteem and happiness. High self-esteem makes people happier and less vulnerable to depression. Yet, research has not reached firm conclusions about causality; most likely, higher self-esteem causes happiness, but other variables might contribute to it. By the same token, low self-esteem is weakly linked to depression, but other factors could intervene in such symptoms.

In conclusion, Baumeister et al. (2003) began the extensive literature review to verify whether people's belief on the importance of self-esteem in life outcomes was real, or was rather platitude. Apart from the link to happiness, self-esteem weakly or modestly predicts most of the other variables. In a broader context, some argue that high self-esteem is not a universal need, but it depends on culture; particularly, it should assume greater importance in western individualist cultures. This hypothesis is partly supported by the fact that detecting self-esteem is more difficult in collectivist countries, such as Japan (Heine et al. 1999). Moreover, self-esteem gives some benefits to the individual, but its costs are borne by others; for instance, narcissism and defensiveness, which are subcategories of high self-esteem, are related to bullying. Bearing in mind these results, it seems that pursuing high self-esteem better suits an individualistic culture.

Another interesting aspect which might generate differences in self-esteem patterns is gender. Early research concluded that gender did not affect self-esteem (Maccoby and Jacklin 1974) or that the diverse nature of the findings could not lead to conclusions (Wylie 1974). The field, however, has recently come to a more unified view on self-esteem, identifying more than one aspect which interplay: gender, age and culture. The most shared view on the trajectory of self-esteem for both males and females is that people have high self-esteem in childhood, which drops in adolescence, and gradually increases in adulthood (Robins et al. 2002). Focusing on gender differences, the most consistent finding is that males tend to report higher self-esteem than females during adolescence (Helwig and Ruprecht 2017; Kling et al. 1999; Major et al. 1999; Robins et al. 2002). Some authors slightly disagree on the

existence of the gap in childhood: Kling et al. (1999), for instance, found gender differences among children, whereas Major et al. (1999) did not. Nonetheless, the core of the gender gap in self-esteem appears to be adolescence. This transitional period features changes which negatively affect adolescents' self-esteem, but girls might be more affected than boys with regard to physical changes (Robins et al. 2002). Moreover, gender stereotypes contribute to heightening the gap: masculinity and self-confidence, for instance, have been associated with higher levels of self-esteem (Marsh 1987).

Notwithstanding, these findings heavily rely on studies of Western cultures, and as we previously noted, different cultural settings might yield diverse outcomes. Some researchers, (e.g., Bleidorn et al. (2016); Helwig and Ruprecht (2017)), recently analysed gender differences in self-esteem using cross-cultural samples of individuals. On one hand, their results corroborate previous findings, on the other hand, they offer useful new insights on the role of culture in self-esteem development. Interestingly, Bleidorn and colleagues (2016) studied individuals from 48 countries and found that countries with higher gross domestic products showed larger gender gaps in self-esteem (i.e., men had more self-esteem than women). Helwig and Ruprecht's results partly disagree with the latter finding, since their analysis of 171 countries showed that the gender gap in self-esteem during adolescence exists within all sociocultural regions, reaching its apex from ages 13 to 15. Furthermore, they found that reported self-esteem in advanced economies (which accounted for 82% of the total countries) was generally lower than that in other regions. Their results show both universal similarities and specific differences in self-esteem.

2.3.5.1 Self-Esteem scale

Self-esteem represents the evaluation of a person about the self. When measuring self-esteem, researchers ask individuals to rate themselves in response to questions such as "Are you satisfied with yourself?" and results are unavoidably biased by the willingness of the individual to appear as a good person. The construct is measured almost exclusively by self-report and, unfortunately, there is no objective criterion against which to compare self-reported self-esteem. Despite this limitation, the fact that scores on different scales are positively correlated suggests that they can be

used with some confidence (Baumeister et al. 2003).

Measures of self-esteem can be either global or at a specific level. Both types of assessment yield advantages and disadvantages. While global self-esteem is deeply related to psychological well-being, specific self-esteem is strongly associated with behaviours (Morris Rosenberg et al. 1995); given that self-esteem is an attitude, the more specific the measure of self-esteem is, the more accurately it should predict a behaviour. For instance, it would be unwise to claim that global high self-esteem predicts performance in a math test (a specific situation), since not everyone considers math ability as relevant when evaluating the self. Nonetheless, "global self-esteem is heavily invested with feelings about the self" (Baumeister et al. 2003, 6), whereas specific self-esteem offers a fragmented view of the construct. For these reasons, global self-esteem – defined as "the individual's positive or negative attitude toward the self as a totality" by Rosenberg et al. (1995, 141) – has been the most preferred measure in the literature.

Among the several global measures of self-esteem that have been designed, the most widely used is the Rosenberg self-esteem scale (RSES) (1965). This scale has been attested to be reliable, internally consistent, and representative of a unidimensional construct (e.g. Shevlin, Bunting, and Lewis (1995)). In our questionnaire, we used the Italian version of the RSES (Prezza, Trombaccia, and Armento 1997), which can be found in the appendix. The scale is a 10-item self-esteem scale in which people are required to indicate their level of agreement with a series of statements about themselves. Since individuals can have both positive or negative evaluations of the self, the RSES contains statements like "I feel that I have a number of good qualities", and by contrast statements like "All in all, I am inclined to feel that I am a failure".

CHAPTER III
DATA ANALYSIS OF A QUESTIONNAIRE ON NON-COGNITIVE FACTORS

3.1 Multistage sampling procedure

The sample of students who filled in the questionnaire analysed in this chapter is not necessarily a random sample. Indeed, the questionnaire was part of a field experiment described in Chapter II and, since most of the schools participating to the experiment self-selected into the research project, we cannot assure that the characteristics of those schools are such that their students are different from the average population (*sample selection bias*).

In this chapter, the unit of observation is each student who completed the questionnaire, and the sampling procedure involved more than one step. The first level of sampling was the region. High schools were randomly selected from four regions in the North-East of Italy (Veneto, Emilia Romagna, Friuli Venezia Giulia and Trentino-Alto Adige). This choice was made on the basis of INVALSI[46] results, which indicate that this area features the highest performing students and the most homogeneous performance, with the lowest variance of scores both among schools and classes (INVALSI 2018). Moreover, the universities which designed the project are located in those regions, thus their reputation might help in encouraging schools to participate and in logistic issues. The sample of schools in North-Eastern Italy included all the different categories of Italian high schools: lyceums (academically oriented), technical institutes and professional institutes (vocational paths). Afterward, a subsample of schools that satisfied some objective criteria (i.e., the size of the school, a maximum ratio of 70-30 between genders) was invited to participate to the project and was randomly assigned to either the control group or the treatments (for more information on the randomization, see Box 2). If the school accepted to take part to the project, each professor in charge of the implementation of the project in a given school (the coordinator) was instructed to randomly select

[46] INVALSI are tests organised by the Italian Ministry of Education and the National Institute for the Evaluation of the Italian Education System. They are written tests held every year among Italian students which aim at assessing learning outcomes in Italian, Mathematics and English.

classes from all academic tracks (e.g., humanities, sciences, administration, technology) and from all five grades of high school (from 9th to 13th grades). Only at this point, students of each selected class were invited to answer the questionnaire.

BOX 2. Experiments with three-level designs: Power of the test and Randomization[47]

Populations of interest in psychology, education, and the social sciences often exhibit multilevel structure. Experiments in education usually involve three levels of nesting, namely multiple schools with multiple classrooms in each school. Individuals within aggregate units are often more similar than individuals in different units; this generates an intraclass correlation structure, otherwise known as *clustering*. One of the challenges researchers must face is ensuring that the design of the experiment is sensitive enough to detect the intervention effects that are expected from a treatment. In other words, sample sizes must ensure sufficient statistical power of the test for the treatment effect, where the power represents the probability of detecting a treatment effect when it exists.

A correct computation of the power of a three-level data experiment and its subsequent analysis should consider the clustering effects which occur at two levels (i.e., schools and classrooms). The larger the clustering effect, the lower the power of the test for the treatment effect. Ignoring one level of clustering in the design of the experiment would lead to an overestimation of the power of an experiment and, given that power computations in field experiments are often thought to be optimistic, it would be appropriate to properly conduct the power analysis. For our experiment, we used the methodology designed by Konstantopoulos (2006). In his paper, the author points out that power is typically higher in three-level designs that assign treatments at lower levels or units (e.g., classes or students); however, considering the design of our field experiment, particularly the prizes for the best students at the Math Olympics, we figured it was cost-effective to assign treatments to the highest level, i.e., schools, which constitute the unit of observation for the experiment. In our study, schools are nested within treatments, and classrooms are nested within schools and treatments. In such a design, the number of schools have proved to impact power much more than the number of classrooms and the number of students.

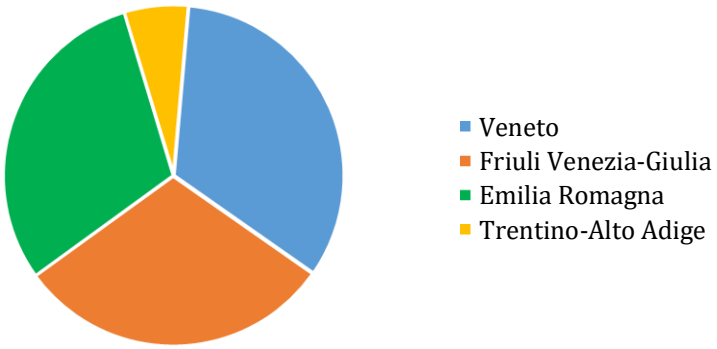
In field experiments, randomization is another essential feature of the design, as it allows researchers to make causal inference. In fact, if randomization methods are properly applied, any difference observed between the treatment and the control group is likely to be the result of the intervention, rather than of pre-existing differences between the groups. In three-level designs, randomization can occur at any level; in our case, it occurred at the school level, that is, schools were randomly assigned to the treatments and the control group.

[47] Reference for Box 2: Konstantopoulos, S. (2006). "The Power of the Test in Three-Level Designs". Institute for the Study of Labor (IZA) Discussion Paper No. 2412.

3.2 Participants

Out of 259 schools invited, only 29 of them participated to the research project (11% of the total); as mentioned in the beginning of this chapter, the low participation rate of schools paves the way for a self-selection bias. The number of students who completed the questionnaire is 6,558[48], with a slightly greater percentage of females than males (52.8% versus 47.1%, respectively). The country of birth was Italy[49] for 95.2% of respondents. The regions chosen for implementing the project are all represented, though not equally (Figure 8).

Figure 8. Location of the schools attended by participant, by region



***Source*: own elaboration**

As for high school categories (lyceums, technical and professional institutes), the vast majority of participating students attended lyceums (77.1%), followed by those attending technical institutes (17.5%) and professional institutes (3.1%) – the remaining percentage (2.3%) answered "other". Among the different tracks of lyceum, *sciences* and *applied sciences* were the most popular (together constituting 76.2% of all lyceum tracks). Most students of technical institutes (58.7%) were part of the economic track (*administration, finance and marketing*), whereas 53.9% of students from professional institutes were studying either *industry and craftmanship* or *technical maintenance.* To conclude, the distribution of participants among high school tracks was not homogeneous, with lyceums (particularly the *sciences* tracks) being the most represented. Conversely, according to our experimental design, all five grades of high school are equally represented, each with a share around 20%. Students are on average 16.5 years old.

[48] Data referring to 3rd February 2020.
[49] Whenever referring to Italy in this study, the Republic of San Marino is included.

As for the family background, a significant proportion of student's parents was born in Italy (85%), though smaller if compared to that of students; notwithstanding, Italian was the most spoken language at home (91.2%). Mothers' level of education was on average higher than fathers': 25.8% of mothers held a university degree and 41.5% obtained a high school diploma (those figures were, respectively, 20.1% and 38.1% for fathers). The higher women's educational level, however, did not translate into higher labour market participation: 15.2% of mothers were housewives, whereas a negligible percentage of men were house husbands. These data support the theory that women's labour participation does not entirely depend on education, as other underlying factors might influence it (e.g., cultural norms). Besides this striking difference, the most common occupations for both parents were blue-collar jobs and the teaching-clerk-military category; additionally, around a fifth of fathers were professionals. Information on the number of brothers and sisters let us to calculate the average family size, which in 57% of cases consisted of 4 family members (an equal share of 18% of households was composed of 3 and 5 family members).

3.3 Students' academic performance, preferences and aspirations

Our questionnaire gathered information on students' academic performance (of the previous year) and preferences, on participation to competitions, and on aspirations. Results for each topic will be presented in this section.

Focusing on performance, students from the 10th grade on were requested to indicate their grade point average (GPA) on a scale from 1 to 10 (in the Italian grading system the minimum grade for passing is 6), whereas students of the 9th grade – which in the previous year had attended middle school and thus, received a grade on a different grading system – were asked to report their grade choosing from five options, namely, *sufficiente, buono, distinto, ottimo, eccellente* [50]. On average, in middle school students obtained *distinto*, whereas in high school a gender gap emerged: females performed better than males, with the average GPA of

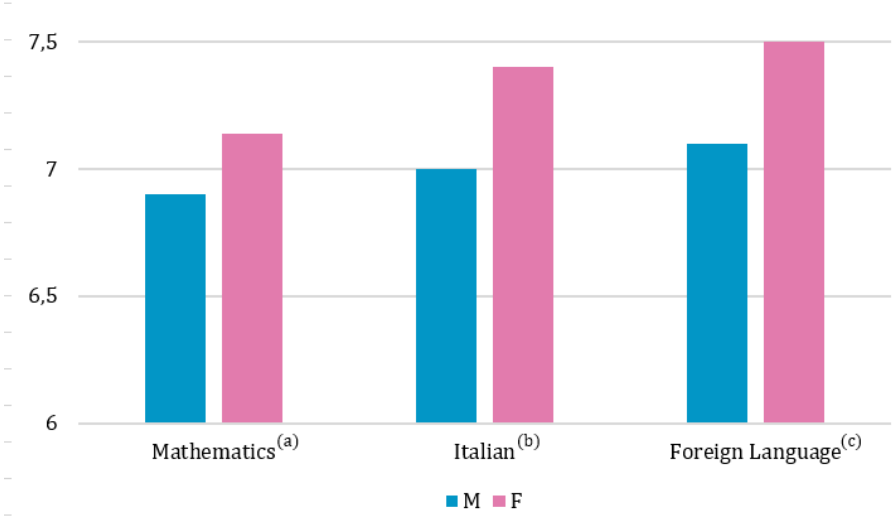
[50] Those grades cannot be properly translated into English; to give an idea to the reader, *sufficiente, buono, distinto, ottimo, eccellente* respectively correspond to 6, 7, 8, 9, 10.

7.6 for girls and 7.2 for boys. Results were statistically significant[51] (t=-13.157, df=5248, p<0.01).

Given the objective of this study, our survey went beyond GPA and collected grades on different subjects, i.e., Mathematics, Italian and Foreign Language, both with regard to preferences and performance[52]. Focusing on preferences, students were asked to rank those school subjects from 1 to 3 (1 being the most preferred and 3 the least preferred). Results show that Italian and Foreign Language were roughly equally distributed in the rank, (i.e., an equal portion of students ranked them as first, second and third), whereas Mathematics was the most preferred for four out of ten students. When it comes to gender patterns, Mathematics is the only interesting subject: almost 44% of males ranked it as first, whereas nearly 40% of females did the same. Rankings for the other two subjects did not show particular structures based on gender.

Despite a slightly stronger preference of boys for Maths, girls performed statistically significantly better in each of the surveyed subjects – though the gender divide was smaller in Mathematics and larger in Italian and Foreign Language (Figure 9).

Figure 9. Performance of students in different subjects, by gender



(a) t=-6.359, df=5248, p<0.01
(b) t=-15.547, df=5248, p<0.01
(c) t=-11.901, df=5248, p<0.01

***Source*: own elaboration**

[51] All results illustrated in this chapter were obtained using the software Stata/IC 14.2.
[52] Given the different grading systems in middle school and high school, those data were collected only for students from the 10th grade on.

These findings partially contradict PISA results for Italy, which recorded a better performance of females in Reading, but a worse performance in Mathematics (OECD 2019)[53]. All in all, our data do not suggest relevant gender differences in maths performance, but looking at the right tail of the distribution (i.e., the top performing students), the divide becomes larger: the share of females who achieved 9 or 10 in maths was 16.35%, while only 12.64% managed to reach the same academic level. Unfortunately, overall better academic results of girls do not translate into higher participation to competitions. When asked if they had participated to Certamen and the Math Olympics (two international competitions in Latin and Mathematics, respectively, held annually for high school students), only 32.3% of girls reported they took part in the Math Olympics (compared to 40.3% of males); Certamen participation rate was likewise higher for males, but the overall share of students who took part in that competition was significantly smaller than for Math Olympics (6.6% of males and 5.2% of females). Our results support a vast literature which found women shying away from competition, even when they have better chances than men to win (e.g., Niederle and Vesterlund (2007)).

When it comes to students' aspirations after high school, two items of our survey can be used as proxies for students' academic choices, namely whether they intend to continue studying at university and which academic path they prefer[54]. Results show that a higher percentage of females (82.4%) reported an interest in higher education, if compared to males (74.6%). Among the remaining students, a tiny portion did not wish to continue studying (3.9% of females and 7.8% of males), whereas others answered "I do not know" (13.7% of females and 17.6% of males). For those who wished to pursue higher education, the choice of the field was moderately gender-biased (Figure 10). When asked to express their preferences for some academic fields (STEM, Social sciences and Humanities, Health, Other), STEM ranked as the first choice for 36.8% of males, but only for 21.6% of females; indeed, for most females STEM ranked last. Girls were more interested in Social sciences and Humanities, the preferred fields for 32.6% of them, and in Health, the first

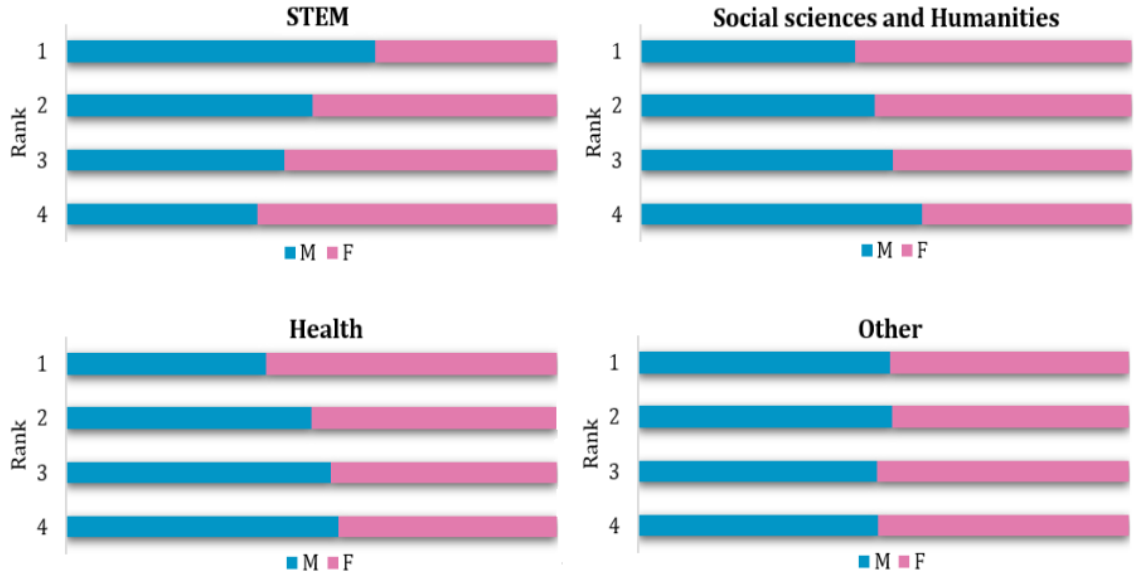
[53] When comparing our results to PISA, *Reading* score in PISA is associated to *Italian* grade in our questionnaire. Foreign Language is not assessed by PISA, thus parallels cannot be drawn.

[54] If not specified otherwise, results on students' academic choices focus on answers of students attending the last two years of high school. We thought that prior to that moment answers could not be representative of students' choices. For completeness, we analysed answers from the rest of students and, if relevant differences were found, they are reported in the text.

choice for 28.5% of them. By contrast, males showed the least interest in Health (19.5% of them ranked it as fourth), whereas one out of four put Social sciences and Humanities at the first position.

Despite being only predictions of choices, these results are in line with previous findings which evidence the underrepresentation of women in STEM and the overrepresentation of women in Health, Social sciences and Humanities (for more details, see section 1.1.1).

Figure 10. Academic field preferences, by gender



Note: 1 indicates the first choice (the most preferred academic field) and 4 the last choice (the least preferred field). Data are elaborated as ratios between male and female students attending the last two years of high school.

***Source*: own elaboration**

It is interesting to note that STEM fields experienced a decline in popularity over high school grades (Table 2). They were more liked by students attending the first three years of high school, especially by boys, whose changes in the ranking were greater than those of girls. For boys, indeed, the upper part of the ranking was most affected (with a decrease of around 5% at the first position), meaning that STEM were less preferred among males attending the last two years of high school. For girls, instead, the last position in the rank was the one which experienced the biggest change, as STEM were the least likely choice for three females out of ten in the last years of high school (while the same was true for two girls out of ten in the first three years of high school). In conclusion, STEM popularity declined over high school grades for both girls and boys, though the trends were different in the ways

explained above. The share of popularity lost by STEM was gained by Social sciences and Humanities (for males and females) and for Health (for females only).

Table 2. Comparison of preferences for STEM across high school grades by gender

Rank |	M *	M **	F *	F **
1 |	41.5%	36.8%	22.9%	21.6%
2 |	24.4%	25.4%	31.7%	25.1%
3 |	16.9%	18.2%	26.3%	22.7%
4 |	17.1%	19.6%	19.1%	30.6%

(*) data from students attending the first three grades of high school (9th, 10th, 11th grades)
(**) data from students attending the last two grades of high school (12th, 13th grades)
***Source*: own elaboration**

3.4 Gender differences in non-cognitive factors: the t test[55]

One of the objectives of this thesis is comparing males and females with respect to several non-cognitive factors measured by a questionnaire. We will apply a two-sample test of group means, thus comparing the means of two samples $\bar{x}_M$, $\bar{x}_F$ (male and female students) to determine whether there is a difference in the two population means μ_M, μ_F from which the samples come (males and females). The test we will use is the parametric[56] *t test* (Formula 1) developed by Gosset, also known as *Student's t test.* Its application is bound to well-defined assumptions: (a) boys and girls are independent samples (i.e., not related in any way); (b) the two samples come from populations in which the variances σ^2_M, σ^2_F are considered as equal; (c) the population variances σ^2_M, σ^2_F are unknown, therefore the sample variances s^2_M, s^2_F must be used to estimate the common variance s^2 of the two samples; (d) the measurement of each variable studied is normally distributed for both populations, i.e. $f(X)_M \sim N(\mu_M, \sigma^2_M)$, $f(X)_F \sim N(\mu_F, \sigma^2_F)$.

[55] References for this section: Stock, J. H., Watson, M. W. *Introduction to econometrics*, 3rd edition (US: Addison-Wesley) (2011) and Black, K. *Applied Business Statistics*, 6th edition (Asia: John Wiley & Sons) (2011).
[56] Parametric tests assume that a given variable follows a specific probability distribution, in our case a normal distribution. Conversely, non-parametric tests do not make such assumptions and for this reason are often called distribution-free tests.

To satisfy the assumption of normality of distribution for both populations, we can apply the central limit theory which states that the distribution of sample means approximates a normal distribution as the sample size becomes larger – no matter what is the shape of the distributions of populations. Therefore, the large size of our sample (n_M=3,095, n_F=3,463) allows the application of the t test.

Formula 1.

$$t = \frac{(\bar{x}_M - \bar{x}_F) - (\mu_M - \mu_F)}{\sqrt{\frac{s^2}{n_M} + \frac{s^2}{n_F}}}$$

with $n_M + n_F - 2$ degrees of freedom (df) and where s^2 is an estimator of the common variance of the two samples calculated as it follows:

$$s^2 = \frac{\sum (x - \bar{x}_M)^2 + \sum (x - \bar{x}_F)^2}{n_M + n_F - 2}$$

Before running the t test, we need to have two hypotheses: a null hypothesis H_0 and an alternative hypothesis H_A. The null hypothesis of the t test is that the difference between the means of the two populations is zero; in our study, the null hypothesis is that the mean values of the non-cognitive factors we measured are equal for males and females, i.e., H_0 : $\mu_M = \mu_F$. The alternative hypothesis can take different forms: (a) females have higher mean score at a certain psychological trait (b) males have higher mean score at a certain psychological trait (c) males and females have different mean scores at a certain psychological trait, but we do not necessarily specify the direction of the difference. In statistical terms, verifying the alternative hypothesis (c) requires a two-tailed test, whereas hypotheses (a) and (b) involve a one-tailed test. When investigating gender differences in non-cognitive factors, our alternative hypothesis will be H_A : $\mu_M - \mu_F > 0$ if we feel confident to state that males have higher scores than females, whereas in the opposite case it will be H_A : $\mu_M - \mu_F < 0$. Finally, if we are not confident about the direction of results, the alternative hypothesis will be H_A : $\mu_M - \mu_F \neq 0$. The choice of the alternative hypothesis will be based on the literature reviewed for each topic in Chapter II.

When deciding whether to accept or reject the null hypothesis, we need to interpret the p-value of the test, that is, the probability of observing a greater

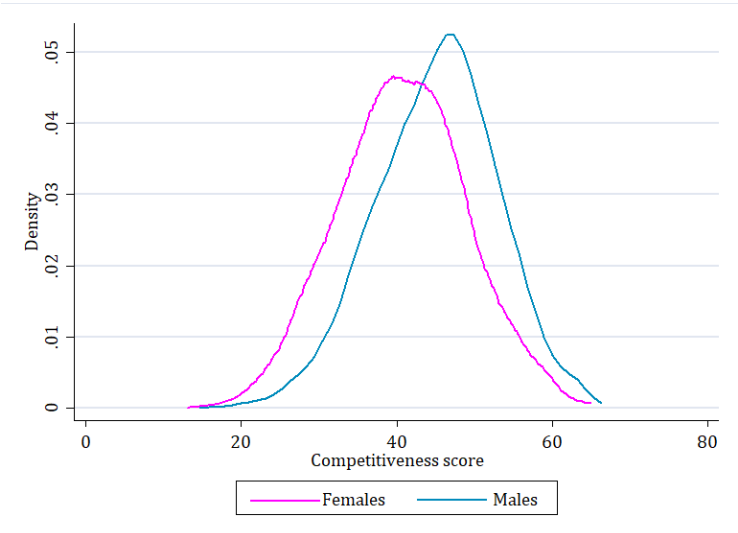
absolute value of t under the null hypothesis. If p-value is less than the chosen alpha level (usually 0.1, 0.05 or .001), we conclude either that (a) the difference between group means is statistically significantly different from zero (for a two-tailed test) or (b) that the difference between the group means is statistically significantly greater or smaller than zero (for a one-tailed test).

3.4.1 Competitiveness

The revised Competitiveness Index by Houston and colleagues (2002) is a personality trait measure we implemented in our questionnaire. A sizable literature indicates how females shy away from competition (see section 2.3.1), therefore in our analysis we support the idea that females will reach lower scores at the index.

Analysis of the index reveals that boys obtained significantly higher scores at the $p<0.01$ level ($t=21.96$, $df=6556$). The average value of the index was 45.1 for males ($SD_M=7.8$, $N=3{,}095$) and only 40.7 for females ($SD_F=8{,}25$, $N=3{,}463$). Additionally, the Epps-Singleton test rejected the hypothesis of equality of distributions of the two samples ($p<0.01$, W2=499.182). Moreover, the density plot of scores in the upper tail indicates how more males reached the highest scores than females did (Figure 11).

Figure 11. Kernel-density plot of Competitiveness Index, by gender



***Source*: own elaboration**

The design of the Competitiveness Index includes two subscales: *Enjoyment of Competition*, which evaluates personal attitudes toward one's competitive

behaviour, and *Contentiousness*, which examines attitude toward avoidant behaviour in arguments and conflicts. Previous studies found that males scored higher than females on *Enjoyment of Competition*, whereas *Contentiousness* did not evidence a gender gap (Houston et al. 2005). Our results support those findings, as the vast majority of the gender gap in the Competitiveness Index was attributable to males scoring on average higher than females in *Enjoyment of Competition* (30.2 versus 26.4; $p<0.01$, $t=25.33$, $df=6556$). Conversely, scores in *Contentiousness* were not significantly different among genders.

3.4.2 Risk and Time preferences

In our questionnaire, we measured both risk and time preferences through an experimentally validated survey, the Global Preference Survey (Falk et al. 2016). Studies which used the same assessment tool across countries found Italian women to be more risk averse and less patient, therefore our hypotheses are that female students will reach lower scores for the risk preference index and for the time preference index.

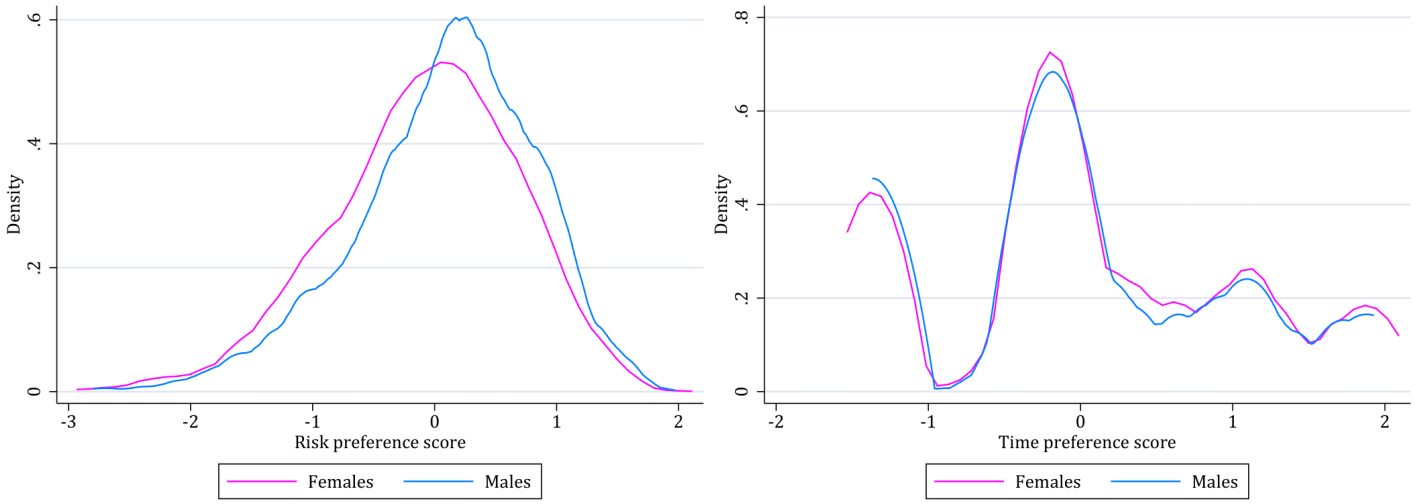
Risk preference was measured through two items, one qualitative (the staircase) and the other quantitative (a scale which asked for willingness to take risks), whereas time preference was measured only by the quantitative item (for more details, see section 2.3.2.1). Following Falk and colleagues' instructions, each item had an almost equal weight on the final score for risk, which was calculated as follows:

$$Risk = 0.4729985 \times Staircase\ risk + 0.5270015 \times Will.\ to\ take\ risks$$

Results partially confirmed previous findings: girls were indeed more risk averse ($p<0.01$, $t=9.046$, $df=6556$) but more patient ($p<0.01$, $z=-2.678$)[57] (Figure 12). Additionally, the Epps-Singleton test rejected the hypothesis of equality of distributions of males and females for time preferences ($p<0.05$, W2=9.897) and risk preferences ($p<0.1$, W2=9.456).

[57] The variable for time preference was not normally distributed, therefore the non-parametric Wilcoxon-Mann-Whitney test was used.

Figure 12. Kernel-density plot of Time and Risk preferences, by gender



Note: higher scores at risk preference indicate higher willingness to take risks; higher scores at time preference indicate higher patience.

***Source*: own elaboration**

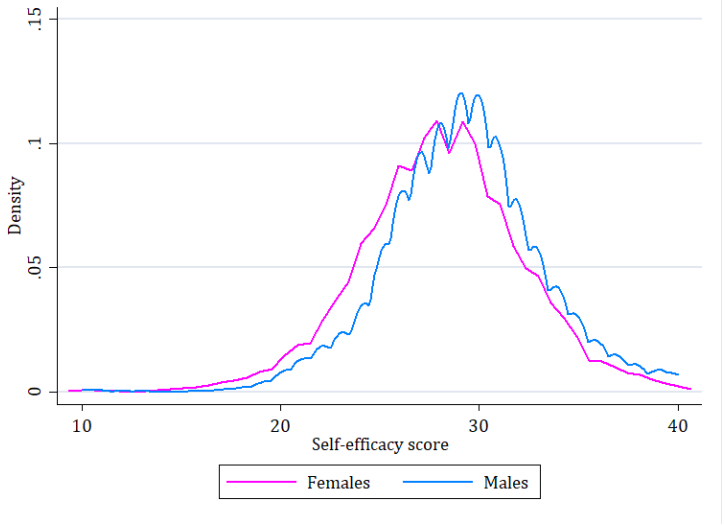
3.4.3 Self-efficacy

In our questionnaire, the construct was measured in two ways: directly through a self-report, that is, the General Self-Efficacy Scale (GSE) by Schwarzer and Jerusalem (1995), and indirectly through the relative ability to solve Raven's Progressive Matrices (RPM) (Raven 1936). Considering previous research on the topic (see section 2.3.4 and 2.3.4.1), our hypothesis is that males are more self-efficacious than females.

Results from the GSE confirm higher self-efficacy for males at the $p<0.01$ level ($t=11.4$, $df=6556$). Overall, students had a good level of self-efficacy, but boys' average GSE score was 29.2 ($SD_M=3.97$, $N=3{,}095$), whereas for girls it was 28 ($SD_F=4.11$, $N=3{,}463$) [58] (Figure 12). When testing the distributions with the Epps-Singleton test, they were found significantly different ($p<0.01$, W2=145).

[58] The range of possible values for the GSE score is 10-40.

Figure 12. Kernel-density plot of General Self-Efficacy Scale score, by gender



***Source*: own elaboration**

When it comes to the RPM, males and females performed equally, with an average of 5 problems out of 9 solved (SD_M =2, SD_F =1.85). The interquartile range was greater for males, thus indicating that performance at RPM was more heterogeneous for males rather than females. What interests us, however, is not the score in RPM per se (which is a measure of cognitive ability), but the difference between the actual performance and how students judged their performance. Participants were asked to indicate how many matrices they thought they managed to solve, and we combined those data (the performance and the self-evaluation) to create a measure of self-efficacy. Overall, students were overconfident (i.e., they thought they solved more matrices than they actually did), but males were found to be statistically significantly more overconfident than females (t=8.59 df=2812, p<0.01). Specifically, males overestimated their performance by one point (male students solved on average 5 problems, but their self-evaluation was 6), whereas females' correspondent value was only 0.3. The distributions were found to be statistically significantly different (p<0.01, W2=20.6).

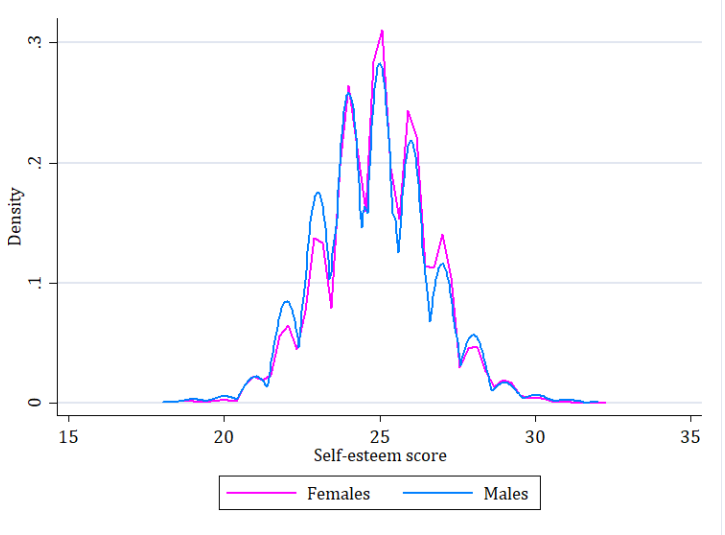
3.4.4 Self-esteem

Our survey implemented the Rosenberg self-esteem scale (RSES) (1965) to assess the level of self-esteem among students. The most consistent finding in the literature is that males tend to report higher self-esteem than females during

adolescence (Helwig and Ruprecht 2017; Kling et al. 1999; Major et al. 1999; Robins et al. 2002), therefore we expect higher RSES scores for boys.

However, when computing the final RSES score[59], females reported a statistically significantly higher score, though the gender divide was negligible ($RSES_F$=24.94, $RSES_M$=24.78; p<0.01, t=-3.52, df=6556). When testing the equality of distributions, the Epps-Singleton test confirmed they were different (p<0.01, W2=28.27).

Figure 12. Kernel-density plot of Rosenberg Self-Esteem Scale score, by gender



***Source*: own elaboration**

Overall, students had a good level of self-esteem; the range of the scale is 0-30, where scores between 15 and 25 are considered normal, whereas scores lower than 15 indicate low self-esteem.

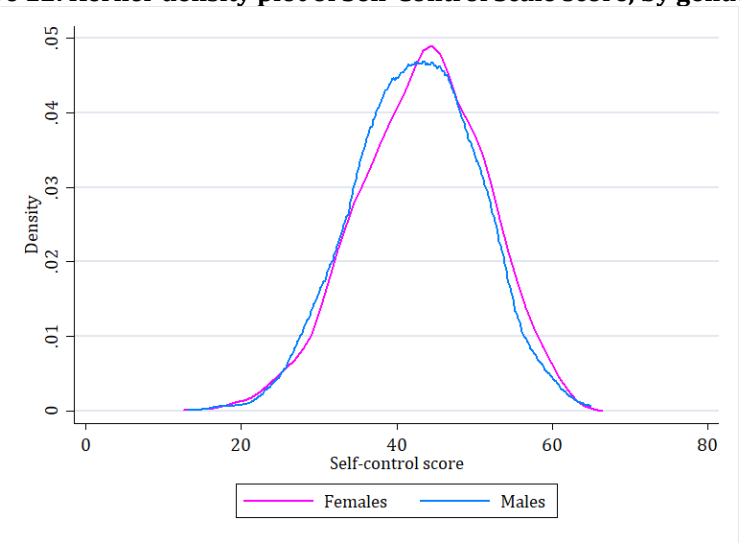
3.4.5 Self-control

In our survey, the psychological trait of self-control was measured through the Brief Self-Control Scale (SCS) by Tangney et al. (2004). To date, the literature has not thoroughly investigated gender differences in this sphere, and the main focus has been on theories of crime (e.g. Gottfredson and Hirschi (1990)) which claim that higher crime rates among boys stem from gender differences in self-control. Consequently, we hypothesize that male students will report lower SCS scores.

[59] The scale contains both negative and positive statements, and negative items were reverse scored to compute the final score.

Results confirm our hypothesis: on a possible range from 13 to 65[59], males reached on average SCS_M=42.2 (SD_M=7.9, N=3,095) and females SCS_F=43.2 (SD_F=7.9, N=3,463). Results were statistically significant at p<0.01 level (t=-3.8.4, df=6556). Moreover, the Epps-Singleton test rejected the hypothesis of equality of distributions (p<0.01, W2=21.29).

Figure 12. Kernel-density plot of Self-Control Scale score, by gender



***Source*: own elaboration**

3.5 Causes of the underrepresentation of women in STEM: Regression analysis

Hitherto, we have compared males' and females' scores at several non-cognitive factors, finding that gender differences do exist. The next step to answer our research question is understanding whether those differences influence the choice of studying STEM fields at university or not. Probit regressions were calculated to predict the aspiration of studying STEM at university (Table 3, reporting marginal effects). The outcome variable is a dummy variable, *stem*, coded as 1 if the student ranked STEM fields as the first choice when expressing preferences for several academic paths, or 0 if otherwise. As for predictors, the model included both traditional predictors and non-cognitive factors.

Traditional independent variables are: *female* (coded as 1 if the student is a girl, and 0 if he is a boy); grade point average of the previous year (*gpa*); grades of the previous year in three school subjects, *mathematics_grade, italian_grade, foreign_language_grade;* high school track, determined by dummy variables which assume value 1 if true, 0 otherwise, namely, *technical_all* for all categories of

technical institutes, *professional_all* for all categories of professional institutes, *lyceum_all* for all categories of lyceums and, finally, *lyceum_sciences* for those lyceum tracks which focus on sciences, applied sciences, or sciences in sport. For the socioeconomical background of the student, parents' professions are grouped into three categories which represent low, medium and high social status[60]; therefore, dummy variables *statusm*- refer to the mother, whereas variables *statusf*- refer to the father, followed by the status level. All of the status variables assume value 1 if true, 0 if false.

Independent variables for non-cognitive factors are the various scores obtained at each questionnaire item; higher values for *self_efficacy_score*, *self_control_score*, *self_esteem_score* and *compet_score* indicate that the student had higher levels of the psychological trait. Moreover, greater *risk_score* translates into being risk lover, whereas greater *time_score* suggests a high level of patience.

At the first layer of analysis, we investigated how traditional variables could predict the probability of choosing STEM at university, Column (1) of Table 3. In support of the broadly documented underrepresentation of women in STEM (Chapter I), a significant gender effect was found, i.e., being female reduced the probability of choosing STEM. Conversely, higher GPA and Mathematics grades increased such probability. Furthermore, if compared to lyceums, attending a professional or technical institute translated into a lower value of the outcome variable. In the second layer of analysis, we included in our model non-cognitive factors alongside traditional ones, Column (2) of Table 3, but results did not find more statistically significant predictors than in the "traditional" model. It seemed that non-cognitive factors could not influence the preference for STEM, but our investigation continued testing the same model for girls and boys separately, Columns (3) and (4) of Table 3. In line with previous studies, results clearly supported the relevance of competitiveness for girls, that is, the highest the level of competitiveness for females, the greater the probability to choose STEM in the future, whereas risk lover boys were less likely to do the same. Moreover, alongside Mathematics grades, Italian grades were found statistically significant for girls; it

[60] A high status corresponds to managerial positions, university professors, military officers, entrepreneurs, landowners, self-employed and professionals; a medium status refers to teachers, clerks, blue-collar workers and retirees; a low status indicates unemployed people and housewives/house husbands.

could mean that while boys rely exclusively on their math abilities when choosing whether to study STEM or not, girls consider their cognitive skills and academic background more broadly.

TABLE 3. ASPIRATION TO STUDY STEM

VARIABLES	(1) Traditional	(2) Trad. & non-cognitive	(3) Trad. & non-cognitive (F)	(4) Trad. & non-cognitive(M)	(5) Sciences lyceum (F)	(6) Sciences lyceum (M)
female	-0.0592***	-0.0566***				
	(0.00854)	(0.00889)				
gpa	0.0219***	0.0227***	0.0251***	0.0202*	0.0649***	0.0321*
	(0.00737)	(0.00746)	(0.00968)	(0.0113)	(0.0181)	(0.0188)
mathematics_grade	0.0285***	0.0286***	0.0227***	0.0349***	0.0265***	0.0441***
	(0.00408)	(0.00408)	(0.00499)	(0.00662)	(0.00817)	(0.00973)
italian_grade	-0.00499	-0.00451	-0.0106*	0.00281	-0.0226**	-0.00406
	(0.00512)	(0.00515)	(0.00638)	(0.00825)	(0.0105)	(0.0120)
foreign_language_grade	-0.00426	-0.00465	-0.00541	-0.00395	-0.00975	0.000255
	(0.00432)	(0.00433)	(0.00527)	(0.00705)	(0.00849)	(0.0102)
technical_all	-0.0595***	-0.0588***	-0.0453***	-0.0750***		
	(0.00849)	(0.00853)	(0.0101)	(0.0143)		
professional_all	-0.0752***	-0.0742***	-0.0693***	-0.0834***		
	(0.0111)	(0.0113)	(0.00970)	(0.0209)		
statusm_high	-0.00786	-0.00899	-0.0118	-0.00654	-0.0135	0.000537
	(0.0116)	(0.0116)	(0.0136)	(0.0194)	(0.0215)	(0.0265)
statusm_medium	-0.00623	-0.00702	-0.0187	0.00787	-0.0176	0.000809
	(0.0104)	(0.0104)	(0.0126)	(0.0173)	(0.0201)	(0.0237)
statusf_high	0.00461	0.00487	0.0217	-0.0109	0.0269	0.0179
	(0.0206)	(0.0206)	(0.0273)	(0.0323)	(0.0423)	(0.0463)
statusf_medium	0.0279	0.0280	0.0372	0.0203	0.0545	0.0515
	(0.0212)	(0.0212)	(0.0281)	(0.0329)	(0.0448)	(0.0495)
self_efficacy_score		0.000240	-0.000585	0.00131	0.000475	0.00215
		(0.00114)	(0.00134)	(0.00193)	(0.00215)	(0.00267)
self_control_score		-0.000708	-0.000931	-0.000345	-0.00301***	-0.000575
		(0.000561)	(0.000666)	(0.000941)	(0.00102)	(0.00128)
self_esteem_score		-0.00138	-0.00364	0.000831	-0.00100	-0.000515
		(0.00236)	(0.00296)	(0.00377)	(0.00466)	(0.00508)
risk_score		-0.00654	0.00340	-0.0173*	-0.00932	-0.0268**
		(0.00569)	(0.00692)	(0.00932)	(0.0110)	(0.0129)
time_score		2.68e-05	-1.69e-05	8.55e-05	-2.76e-05	7.70e-05
		(4.63e-05)	(5.69e-05)	(7.52e-05)	(8.82e-05)	(0.000103)
compet_score		0.000628	0.00113*	-0.000178	0.00216**	-0.000131
		(0.000531)	(0.000629)	(0.000893)	(0.000982)	(0.00118)
Observations	5,250	5,250	2,789	2,461	1,609	1,717
Pseudo R-squared	0.0690	0.0702	0.0618	0.0686	0.0709	0.0570

Probit regressions, reporting marginal effects
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Given the strict connection between STEM and sciences lyceums, we then tested the model on students attending this category of high school, Columns (5) and (6) of Table 3. For boys, no significant differences were found in comparison to the results

for all high school tracks; for girls, instead, self-control emerged as a statistically significant predictor. Specifically, having a high level of self-control decreases the probability of studying STEM, at least for girls who attend sciences lyceums. We speculate that this might be due to the persistent exposure to gender norms and stereotypes. Self-controlled individuals are reflective and they carefully evaluate their choices to meet expectations and standards; however, those expectations and standards are not only imposed by the self, but also by parents, teachers and peers. Therefore, the fact that girls of sciences lyceums may have already been subject to the "male-sciences" or "male-maths" stereotypes might steer them away from STEM. Conversely, the lower the self-control, the more impulsive is the individual. From this standpoint, less self-controlled girls might decide their academic path more spontaneously, thus following their true interests and inclination, and attending a sciences lyceum already suggests a propensity towards STEM fields.

Given the results obtained above, we then used multiple linear regressions to explore what might explain competitiveness and self-control. The models included all variables which were previously referred to as "traditional", i.e., gender, socioeconomical background, academic performance and high school track. Column (1) of Table 4 showed that, as expected, gender was the strongest predictor of competitiveness, i.e., being female leads to lower competitiveness, whereas the socioeconomical background was found statistically significant in the opposite direction, that is, the higher the status of parents, the more competitive the student. Moreover, the model suggested that students attending a professional institute are not as competitive as those attending other high school tracks.

Since competitiveness was found relevant in the choice of STEM only for girls, we decided to run two separate regressions for males and females, Columns (2) and (3) of Table 4. Both socioeconomical background and grades at subjects yielded diverse results: for boys, a high status of the father implies higher competitiveness, whereas for girls it is the mother's status (medium/high) which impacts attitude to competition. Furthermore, good grades at Italian positively influence competitiveness for girls, while Mathematics does the same for boys. Despite girls' better grades at each of the three subjects, Mathematics and Foreign Language do not seem to boost their competitiveness level. Those differences in the way parents' status affected boys and girls led us to test whether an extreme gap in the status of

the mother and father would still yield the same results. We tested two models: (a) the mother has a high status and the father has a low status, Columns (4) and (5) of Table 4; (b) the mother has a low status and the father has a high status, Columns (6) and (7) of Table 4. We ran those two regressions for girls and boys separately to be able to observe any gender issue. Results confirmed the widely shared notion that role models have an impact on behaviour. However, a closer look at regression results highlighted another interesting finding: females' competitiveness is sensitive only to the status of the mother (that is, if high, the competitiveness increases, if low, it decreases). Boys' level of competitiveness, instead, does not depend on which parent has a high status; in other words, either the mother's or the father's high status significantly predict better attitude to competitiveness.

TABLE 4. COMPETITIVENESS

VARIABLES	(1)	(2) F	(3) M	(4) F	(5) M	(6) F	(7) M
female	-4.865***						
	(0.230)						
statusm_high	1.206***	1.795***	0.579			1.225***	0.649*
	(0.331)	(0.472)	(0.461)			(0.358)	(0.351)
statusm_medium	0.689**	0.832**	0.504				
	(0.287)	(0.406)	(0.404)				
statusf_high	1.023*	0.441	1.673**	0.335	1.381***		
	(0.525)	(0.757)	(0.723)	(0.319)	(0.318)		
statusf_medium	0.375	0.388	0.366				
	(0.525)	(0.754)	(0.726)				
gpa	0.236	0.343	0.191	0.322	0.193	0.344	0.185
	(0.192)	(0.299)	(0.248)	(0.299)	(0.248)	(0.299)	(0.249)
mathematics_grade	-0.102	0.0588	-0.274*	0.0580	-0.274*	0.0747	-0.278*
	(0.109)	(0.158)	(0.149)	(0.158)	(0.149)	(0.158)	(0.150)
italian_grade	0.307**	0.412**	0.152	0.415**	0.159	0.426**	0.201
	(0.139)	(0.205)	(0.189)	(0.204)	(0.189)	(0.205)	(0.190)
foreign_language_grade	0.234**	0.252	0.188	0.263	0.186	0.252	0.199
	(0.116)	(0.166)	(0.162)	(0.166)	(0.161)	(0.166)	(0.162)
technical_all	0.178	0.116	0.266	0.0968	0.275	0.0120	0.111
	(0.293)	(0.406)	(0.420)	(0.406)	(0.420)	(0.405)	(0.420)
professional_all	-2.410***	-1.850**	-2.921***	-1.890**	-2.938***	-2.062**	-3.243***
	(0.598)	(0.910)	(0.785)	(0.907)	(0.783)	(0.904)	(0.783)
statusm_low				-1.414***	-0.617		
				(0.400)	(0.400)		
statusf_low						0.348	-0.752
						(1.444)	(1.247)
Constant	39.27***	31.58***	42.13***	33.06***	42.91***	32.35***	43.11***
	(1.105)	(1.664)	(1.510)	(1.539)	(1.397)	(1.536)	(1.398)
Observations	5,250	2,789	2,461	2,789	2,461	2,789	2,461
R-squared	0.089	0.021	0.020	0.020	0.020	0.020	0.013

Multiple linear regressions, reporting coefficients
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Considering the results obtained from probit regressions, the model for self-control was tested exclusively on those students attending sciences lyceums. Column (1) of Table 5 confirms the significance of gender in self-control scores, with females having higher scores. Moreover, in line with previous studies, there is a positive relationship between self-control and academic performance (mainly at Italian). However, we are not confident to state that academic performance is a predictor of self-control; indeed, the opposite could be true, thus any conclusion should be drawn with caution as there might be a problem of *reverse causality*.

TABLE 5. SELF-CONTROL

VARIABLES	(1)	(2) F	(3) M
female	0.585**		
	(0.274)		
statusm_high	-0.951**	-1.219**	-0.747
	(0.398)	(0.584)	(0.544)
statusm_medium	-0.735**	-0.446	-1.023**
	(0.356)	(0.519)	(0.490)
statusf_high	1.168*	2.159**	0.441
	(0.668)	(0.985)	(0.910)
statusf_medium	0.887	1.810*	0.252
	(0.674)	(0.988)	(0.924)
gpa	2.020***	2.813***	1.563***
	(0.269)	(0.444)	(0.337)
mathematics_grade	0.166	0.0145	0.220
	(0.140)	(0.210)	(0.191)
italian_grade	0.807***	0.619**	0.891***
	(0.179)	(0.272)	(0.240)
foreign_language_grade	-0.208	-0.507**	0.0365
	(0.148)	(0.212)	(0.207)
Constant	21.78***	20.06***	23.15***
	(1.363)	(2.118)	(1.829)
Observations	3,326	1,609	1,717
R-squared	0.093	0.094	0.083

Multiple linear regressions, reporting coefficients
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The influence of socioeconomical background on self-control is less clear: when testing the model for males and females separately, Column (2) of Table 5 shows that a high status of the mother negatively influence self-control for girls, whereas the opposite is true for the father's status, i.e., a medium/high status increases self-control scores. For boys, instead only a medium status of the mother negatively affects their ability to self-control, whereas the father's status is not significant, as shown in Column (3) of Table 5.

3.6 Discussion

The objective of this chapter is understanding whether gender differences in non-cognitive factors contribute to the largely observed phenomenon of the underrepresentation of women in STEM. The literature has most often investigated "traditional" explanations, such as cognitive abilities. However, females often achieve higher academic results than males, and in our study girls have higher grades in all of the surveyed subjects. Other factors, thus, might influence higher education choices.

As a first step, a comparison of boys' and girls' scores at several non-cognitive factors reveals that, in line with the existing literature, girls are less competitive, more risk averse, less self-efficacious, but with more self-control. In contrast with previous studies, females have slightly more self-esteem and patience than males, although differences are not substantial.

Afterward, the analysis shifts to evaluating if those gender differences influence the choice of studying STEM. In our regression models, both traditional and non-cognitive factors are examined, and results indicate that attending lyceums and achieving higher GPA and Mathematics grades increase the probability of studying STEM. For girls, other than these variables, a good performance in Italian is positively related with choosing STEM; while male students appear to rely exclusively on their math abilities when choosing whether to study STEM or not, this finding could be interpreted as a broader notion of academic background for females. Nonetheless, as expected, girls are less likely to choose that path, with most of them preferring Social sciences, Humanities and Health. Our findings match larger investigations which evidence a dearth of women in STEM and an overrepresentation in other fields.

When it comes to non-cognitive factors, their relevance in tertiary education choices is not consistent between genders. In fact, while less competitive girls have a lower probability of studying STEM, the same is true for risk averse boys. Moreover, focusing our analysis on sciences lyceums – given their strict connection with STEM – self-control emerges as a significant deterrent to choosing STEM for girls.

The negative relationship between scores at the competitiveness index and the choice of studying STEM is further supported by the low participation rates of girls

at the Math Olympics, an international competition of Mathematics. As well-documented in the literature, women shy away from competition even when performing better (in our case, when having higher grades at Maths). Turning to the major determinants of competitiveness, the socioeconomical background, high school track and grades seem to play a key role. Of these factors, however, only the category of school influences competitiveness in the same way for boys and girls: students attending a professional institute are not as competitive as those attending other high school tracks. Conversely, the other variables differently affect competitiveness. The rationale for the relationship between competitiveness and the socioeconomical background is that a higher family status might positively impact competitiveness, and results show that parents act as role models indeed; in other words, the higher the family social status, the higher the competitiveness of the student. However, while boys benefit from a higher status regardless of which parent holds it, for girls only the high status of the mother predicts a better attitude to competition. In other words, mothers act as stronger role models than fathers for girls.

As for self-control, in line with the prior studies, it is positively correlated to academic performance, but self-controlled girls attending sciences lyceums appear to be less likely to pursue a career in STEM. The literature has most often depicted self-control as a positive psychological trait for life outcomes, but our results suggest that it discourages girls from studying STEM. This finding might be related to the persistent stereotypes in society (e.g., parents, teachers, media, peers). Indeed, girls from sciences lyceums may be more exposed than others to the "male-sciences" or "male-maths" paradigms, and since self-controlled individuals think longer about their decisions, girls' choice could be biased by stereotypes. By contrast, more impulsive people act more spontaneously, and if impulsive girls study sciences at high school, they might continue following their true interests studying STEM without feeling constrained by stereotypes.

Additionally, the influence of the socioeconomical background on girls' self-control leads to mixed results: while a high status of the mother negatively affects self-control, the opposite is valid when the father is the one in a position of prestige. This pattern may partially confirm the unequal division of responsibilities between parents when raising their offspring. It is likely that mothers bear most of the

responsibilities, and when they are in positions of high status, they could have less time to devote to their daughters and sons. Consequently, boys and girls may be less controlled and, in turn, develop lower self-control.

The present study is not without limitations. Firstly, the participation rate of schools to the research project was low, paving the way for a self-selection bias. Indeed, the characteristics of those schools which accepted could be such that their students are different from the average population. Secondly, despite the numerosity of the sample, the share of students attending lyceums (especially sciences) was disproportionately high. Lastly, some prediction models could be affected by reverse causality (e.g., when trying to predict self-control with academic performance).

More generally, the present findings are consistent with a sizeable body of research showing gender differences in non-cognitive factors. Our data further confirm the relevance of gender in attitude to competition, which in turn influences the probability to study STEM. Furthermore, results cast a new light on self-control which, in some circumstances, might act as a deterrent to following true interests in STEM. Ideally, findings should be replicated in a study where self-selection bias could be ruled out by high participation rates. Finally, a more homogeneous distribution across high school tracks could reveal new insights into other mechanisms acting on students' choice to study STEM.

CONCLUSIONS

This thesis aimed at evaluating whether gender differences in non-cognitive factors contribute to the phenomenon of the underrepresentation of women in STEM. The prominent role of STEM in today's economy calls for an investigation of the gender gap in such fields, alongside motivations related to gender equality. Closing the gender gap in STEM would bring relevant economic advantages. For instance, high-tech human capital boosts innovation and productivity, therefore attracting more women to STEM would likely result in GDP growth. Additionally, eliminating the gender gap would help solving some major labour market issues, such as skill shortages and consequent recruitment difficulties in STEM. According to forecasts, demographic patterns such as the ageing population will lead to a great number of STEM-related job vacancies, which even today are hard to fill; among the main reasons, a lack of applicants with the required qualifications is often reported, which in turn derives from gendered job images, the main deterrent to a balanced pool of available talents in STEM occupations. It appears clear that in rapidly aging economies, engaging more females in STEM labour market could mitigate the effects of a shrinking workforce.

Notwithstanding, attracting more women to STEM is not a simple task.

The first chapter of this thesis provides evidence that improvements in women's labour market participation registered over the last decades have largely been due to women entering traditionally female jobs, and chances to be employed in STEM are significantly lower for women if compared to those of men. Gender segregation contributes to the perpetuation of unequal gender power, and ultimately leads to discrimination. In general, women in the labour market are affected by both horizontal and vertical segregation, and unfortunately women in STEM are not the exception. Although differences in occupational outcomes are largely attributable to educational choices – with women concentrating on a limited spectrum of fields, such as Humanities and Social sciences – horizontal segregation is further reinforced in the transition from tertiary education to employment. A higher presence of women in STEM universities does not necessarily translate into a higher participation to STEM labour market as, during this transition, gender channels

young graduates into the labour market. Even when women obtain a degree in science-related fields, they are less likely to pursue a science career than men, often ending up in jobs which do not mirror their potential and skills – a phenomenon commonly pictured as the "leaky pipeline".

Women's and men's paths tend to diverge also in terms of career advancement, with women climbing the ladder more slowly than men (vertical segregation). Family responsibilities, usually heavier for women, limit their time available for employment (which partly explains their preference for part-time jobs) and their geographic mobility. However, family cannot be the only determinant of vertical segregation, since women with few household responsibilities similarly advance more slowly than men. The crux of the matter lies in women being often unwelcome in STEM working environments, where stereotypes and preconceived ideas overshadow the benefits that gender diversity could bring to organizations. This inefficiency in talent management might help explain the low share of women in STEM managerial positions around the world, which may be subject to gender biases in the recruiting process.

STEM fields are strongholds of gender segregation and, on top of that, the gender pay gap and the "motherhood penalty" further hinder women's professional experience. Although both gender differences in wages and the negative consequences of motherhood on the labour market are less severe in STEM than in other sectors, studies demonstrate that the more women in a given STEM field, the lower the earnings for them. Thus, the degree of feminization seems to be inversely related to women's earnings.

In the second chapter of the present thesis, we focus on the determinants of the underrepresentation of women in STEM. The economic literature has often investigated traditional economic variables such as discrimination and human capital accumulation to explain any gender difference. However, in the case of STEM, a sizeable component of the gap cannot be explained by those variables; for instance, girls perform equally or better than males at university, but when entering the job market, they often prefer working in non-STEM occupations. Consequently, more recent theories are shifting the attention from traditional economic models towards unconventional factors. Differences in psychological attributes, or non-cognitive factors, are being proposed among the possible causes of the underrepresentation

of women in STEM. In the second chapter, a literature review highlights the effects of these factors on life outcomes. For instance, a good attitude to competition affects both educational choices, such as taking an entry exam to a highly selective university, and professional outcomes, with competitive students having a higher starting salary. Mathematics, one of the key skills to succeed in STEM, has been recognized as a catalyst for success together with competitiveness: girls who pursue more math-intensive college degrees choose more competitive careers, climb higher up the career ladder and have greater incomes. Given that both good attitude towards competition and the choice of math specializations are relevant factors in success, women's lower competitiveness and lower preference for math-intense courses may partially explain the gender gap in top positions in STEM. Two other elements appear to be inextricably linked with gender differences in competitiveness: success and failure. Indeed, while males attribute success to internal factors (e.g., talent) and failure to external factors (e.g., luck), females do exactly the opposite. The two approaches heavily impact the willingness to compete and, in fact, when women fail in a competition, they are significantly less likely to enter it again.

Focusing on risk preferences, risk aversion is often linked to more stable occupations which, however, yield lower earnings. Gender differences in risk preferences have been attributed to diverse emotional reactions to uncertainty, with women seeing risk as a threat and men considering it as a challenge. However, an interesting line of research on managers and professionals has failed to detect gender differences, thus the widely shared idea that women dislike risk might not apply to all women and might be linked to other factors, such as competitiveness and self-efficacy. For time preferences, instead, the literature is more modest in size and essentially highlights how patience and the ability to delay gratification are positively related to educational attainment and employment. Studies on gender differences have led to mixed results, with some finding women more patient, whereas in others the gap was null or reversed.

Turning to other psychological traits, self-efficacy enhances personal well-being in several ways. Indeed, beliefs about what people can do shape their motivation and guide their actions. An interesting finding concerns the link between self-efficacy and the perception of intelligence. Several studies emphasize the benefits of

adopting a "growth mindset", that is, thinking of intelligence as a malleable quality that can be developed. Among them, better students' accomplishments, greater motivation to acquire new skills and, last but not least, better grades at mathematics. When exploring self-efficacy as one of the causes of a dearth of women in STEM, several studies suggest a connection with mathematics. Females' self-efficacy levels broadly depend on gendered social practices implemented in various contexts. For instance, parents generally believe that boys are innately better equipped with quantitative skills than girls. In schools, teachers' implicit stereotypes heavily influence both math performance and academic track choice. Simply stating a gender stereotype (in our case, women's lower math skills) is detrimental to the perceived math self-efficacy of girls, as it creates anxiety which, in turn, negatively affects their performance – a phenomenon widely known as "stereotype threat". Taken together, these actions ultimately discourage females from studying STEM. In other words, the low proportion of women in STEM might largely derive from discouragement to pursue quantitative careers, rather than actual inability.

Self-control is generally considered as a relevant factor in human quality of life, benefiting both the individual and others who surround him. Findings indicate higher self-control levels for women and, as stated for other traits, self-controlled people perform academically better, they have higher self-esteem and better interpersonal relationships. Additionally, in adolescence, self-control helps teenagers refraining from drug and alcohol abuse. The literature on gender differences in self-control, however, is not as developed as for other topics and, to date, theories have mainly focused on crime.

Finally, one of the most studied constructs in the modern social sciences is self-esteem. People experience the greatest changes in self-esteem concomitantly with major successes and failures, and they intuitively believe that self-esteem is a relevant factor in life. However, from this piece of information it is not possible to establish whether self-esteem is the cause or the outcome. Several authors have investigated the topic to establish the direction of causality and, besides suggesting that high self-esteem might cause happiness, other variables such as good performance, health and good relationships were weakly predicted by self-esteem. In short, it is likely that successes lead to higher self-esteem and not the reverse; however, this does not imply that the concept is trivial, as either way people

attribute to self-esteem a key role in life outcomes. Turning to gender patterns, age seems to play an equally crucial role: both males and females have high self-esteem in childhood, which drops in adolescence, and gradually increases in adulthood. Nevertheless, girls' self-esteem is more negatively affected by adolescence, during which they have lower levels than boys.

Following this new strand of research which explores non-cognitive factors as possible determinants of a dearth of women in STEM, we designed – as part of a broader research project – a questionnaire to measure attitude to competition, risk and time preferences, self-efficacy, self-control and self-esteem. Our purpose was twofold: on one hand, we intended to verify whether gender differences in non-cognitive skills exist and, on the other hand, we wanted to establish if those differences influence females' and males' aspiration to study STEM.

In the third chapter of this thesis, we analyse the questionnaires completed by 6,558 high school students. In line with the existing literature, girls were found to be less competitive, more risk averse, less self-efficacious, but with more self-control. In contrast with previous studies, instead, females had slightly more self-esteem and patience than males, although differences were not substantial. When investigating if those differences had an impact on students' aspirations, both traditional and non-cognitive factors were held into account. As for traditional variables, attending lyceums and achieving higher GPA and Mathematics grades raised the likelihood of studying STEM. Moreover, as expected, results showed that being female translated into a lower probability to choose STEM at university, with most of them preferring Social sciences, Humanities and Health. Despite being only predictions of choices, our results are in line with studies which document a dearth of women in STEM and an overrepresentation in other fields. When assessing the relevance of non-cognitive factors, results were multi-faceted: while in general less competitive girls were less likely to study STEM, the same was true for self-controlled female students attending sciences lyceums.

The above findings led us to investigate the determinants of both competitiveness and self-control, in an attempt to detect any underlying mechanism. For competitiveness, the high school track was found as a major determinant, with girls attending professional institutes being not as competitive as those attending lyceums and technical institutes. Moreover, the socioeconomical background

significantly affected girls' attitude to competition; more specifically, it was only the high status of the mother that predicted higher levels of competitiveness of girls. In other words, mothers acted as stronger role models than fathers for girls.

Turning to self-control, in line with the prior studies, a positive correlation with academic performance was found. The literature has most often depicted this psychological trait as a positive influence on life outcomes, but our results indicate that self-control might discourage girls attending sciences lyceums from studying STEM. We speculate that this might be due to the persistent stereotypes to which girls from sciences lyceum may be more exposed than others. Among those preconceived ideas, the "male-sciences" or "male-maths" paradigms are prominent examples of gender stereotypes perpetuated by society (e.g., parents, teachers, media, peers). In fact, since individuals with high self-control carefully evaluate their choices, self-controlled girls might allow stereotypes to bias their choice of academic path. Conversely, more impulsive girls might act more spontaneously, and thus continue following their true interests from sciences lyceums to STEM faculties. The role of the socioeconomical background was less clear: while a high status of the mother negatively affected self-control, the opposite was true when the father was the one in a position of prestige. This finding may partially confirm the shared idea of unequal division of responsibilities between parents when raising their offspring. Mothers often bear most of the responsibilities, and it is likely that when they are in positions of high status, they could have less time to devote to their daughters. Consequently, girls may be less controlled and, in turn, develop lower self-control.

In general, our findings match the existing literature which evidences gender differences in non-cognitive factors. The prominent role of gender in attitude to competition is further affirmed and expanded to the choice of the academic path, with less competitive females avoiding studies in STEM. Furthermore, our results provide new insights into self-control which, for girls studying sciences at high school, might act as a deterrent to following their true interest in STEM at university. To date, the literature has not thoroughly investigated gender differences in this sphere and the main focus has been on theories of crime; future studies could explore how self-control interplay with gender stereotypes in educational and professional choices.

The relevance and the role of non-cognitive factors, however, might not be universal. A psychological trait may be important for choices of some individuals, but not for others; analogously, the same non-cognitive factor may influence different individuals in opposite directions. In general, both biological differences (a “nature” explanation) and environmental circumstances (a “nurture” explanation) might determine the magnitude of those gender differences in life outcomes. For instance, there is evidence that from early life stages children are exposed to stereotypes which end up forming an unintended and often invisible barrier to equal opportunities. Assessing the relative importance of nature versus nurture would help addressing the issue: if gender differences were due to nurture, then they could be changed. Moreover, one might wonder whether they are true differences in preferences or rather biases; if the latter was true, raising awareness of those differences could "debias" both females’ and males’ behaviours. As a last consideration, future research could explore whether the environment in which an individual takes a decision can be modified in a way that reduces or eliminates gender differences (for instance, by avoiding the activation of a psychological trait which presents larger gender differences). This last approach to gender issues entails a change of paradigm, as researchers would not only study choices and behaviours, but they could also actively design choice environments, making them less dependent on psychological attributes.

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APPENDIX

"Le differenze di genere nella partecipazione alle Olimpiadi della Matematica Italiane"

Valeria Maggian[61], Natalia Montinari[62], Antonio Nicolò[63]

Il presente questionario verrà realizzato tramite Qualtrics, fornendo agli studenti delle scuole partecipanti un link a cui accedervi tramite smartphone, pc o tablet. Solo gli studenti (minorenni) i cui genitori hanno acconsentito alla partecipazione al questionario possono parteciparvi. Allo stesso modo, gli studenti maggiorenni dovranno consegnarci il loro consenso informato. Tutti i documenti sono disponibili nei files allegati.

NOTA: Le domande da 1 a 16 verranno presentate sempre in questo ordine mentre le domande successive verranno presentate con ordine CASUALE. Le informazioni contenute nelle parentesi quadre NON saranno mostrate ai partecipanti.

Benvenuto/a, ti chiediamo di rispondere ad una serie di domande. La compilazione del questionario durerà circa 60 minuti. Ti daremo delle istruzioni relative alle diverse parti che incontrerai.

Parte 1. Ti chiediamo di rispondere alle seguenti domande.

[Domande "de-identificative"]

1. Scuola:
2. Anno di corso
3. Sezione:
4. Genere:
5. Data di nascita:

[Informazioni sulla famiglia e composizione familiare]

6. Titolo di studio di tuo padre (1=Licenza elementare; 2=Licenza media; 3= Qualifica professionale triennale; 4= Diploma di scuola secondaria superiore; 5=Altro titolo di studio superiore al diploma; 6=Laurea; 7=Non so; 77=Non valida; 99=Mancante)
7. Professione di tuo padre (1= Disoccupato/a; 2= Si occupa della casa; 3= Dirigente; docente universitario; funzionario; ufficiale militare; 4= Imprenditore; proprietario agricolo; 5= Professionista dipendente; sottufficiale militare; libero professionista; 6= Lavoratore in proprio; 7= Insegnante; impiegato; militare graduato; 8= Operaio; addetto ai servizi; socio di cooperativa; 9= Non so; 10= Pensionato/a; 77=Non valida; 99= Mancante)
8. Titolo di studio di tua madre (1=Licenza elementare; 2=Licenza media; 3= Qualifica professionale triennale; 4= Diploma di scuola secondaria superiore; 5=Altro titolo di studio superiore al diploma; 6=Laurea; 7=Non so; 77=Non valida; 99=Mancante)

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[62] University of Bologna.
[63] University of Padova and University of Manchester.

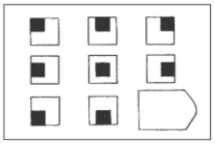
9. Professione di tua madre padre (1= Disoccupato/a; 2= Si occupa della casa; 3= Dirigente; docente universitario; funzionario; ufficiale militare; 4= Imprenditore; proprietario agricolo; 5= Professionista dipendente; sottufficiale militare; libero professionista; 6= Lavoratore in proprio; 7= Insegnante; impiegato; militare graduato; 8= Operaio; addetto ai servizi; socio di cooperativa; 9= Non so; 10= Pensionato/a; 77=Non valida; 99= Mancante)
10. Nazione in cui sei nato (1= Italia (o Repubblica di San Marino); 2= Unione Europea; 3= Paese Europeo Non UE; 4= Altro; 7=Non valida; 9=Mancante)
11. Nazione di nascita di tuo padre (1= Italia (o Repubblica di San Marino); 2= Unione Europea; 3= Paese Europeo Non UE; 4= Altro; 7=Non valida; 9=Mancante)
12. Nazione di nascita di tuoa madre (1= Italia (o Repubblica di San Marino); 2= Unione Europea; 3= Paese Europeo Non UE; 4= Altro; 7=Non valida; 9=Mancante)
13. Lingua parlata a casa (1=Italiano; 2=Albanese; 3=Arabo; 4=Cinese; 5=Croato; 6=Francese; 7=Greco; 8=Indi; 9=Inglese; 10=Ladino; 11=Portoghese; 12=Romeno; 13=Sloveno; 14=Spagnolo; 15=Tedesco; 16=Una lingua diversa da quelle elencate; 77=Non valida; 99=Mancante)
14. Numero di sorelle ed età
15. Numero di fratelli ed età

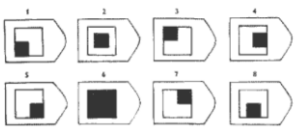
Parte 2. In questa parte del questionario avrai X minuti di tempo per rispondere correttamente a 9 domande. Al termine del tempo sarai automaticamente indirizzato alla parte successiva.

[Domanda su abilità non cognitive e abilità relativa]

16. Ora ti chiediamo di risolvere alcuni problemi logici. Per ogni problema, vedrai un'immagine in cui un pezzo è mancante. Sotto ogni immagine ci saranno più opzioni. Tra queste opzioni, solo una completerà l'immagine. Ti chiediamo di indicare quale di queste opzioni dovrebbe essere inserita per completare l'immagine.

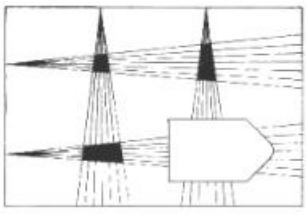
    Esempio. Nell'esempio qui sotto, il pezzo mancante per completare la figure è rappresentato dall'opzione 5. In ogni riga dell'immagine, un grande quadrato bianco include un piccolo quadrato nero posizionato a destra, al centro, o a sinistra. Quello che cambia in ogni figura è il fatto che il piccolo quadrato nero sia posizionato nella parte più alta, centrale o più bassa del quadrato bianco più grande.

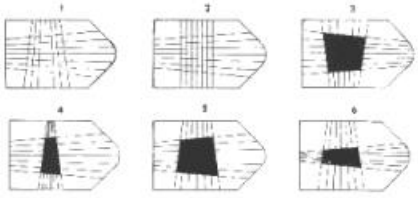




Ogni problema ha solo una soluzione logica. Per ogni problema ti chiediamo di selezionare la risposta che ti sembra più corretta. Prova a risolvere il più grande numero di problemi nel tempo assegnato ma non ti aspettare di risolverli tutti.

PROBLEMA 1





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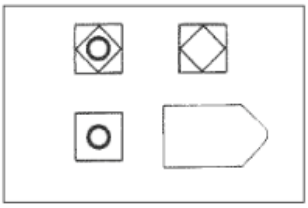

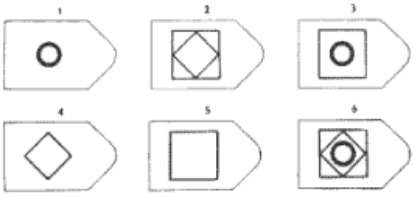

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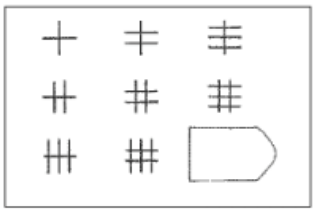

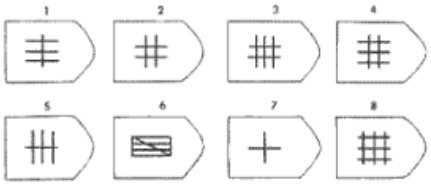

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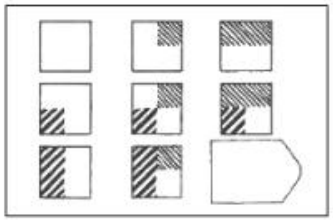
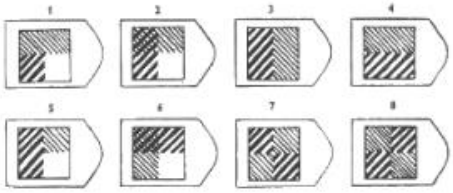
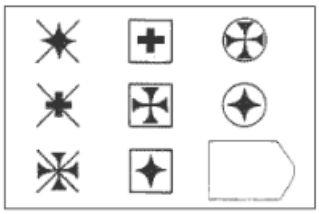
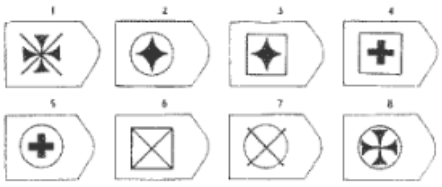


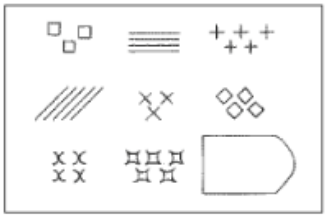


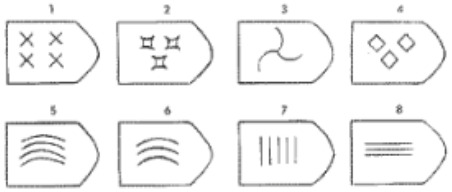
PROBLEMA 5



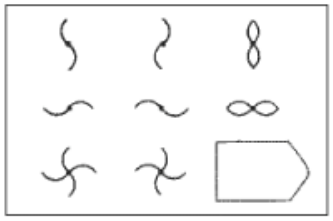


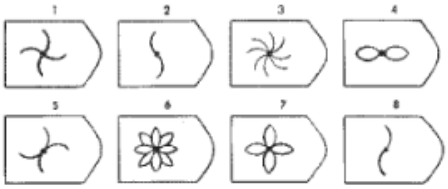
PROBLEMA 6



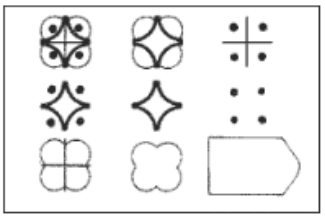


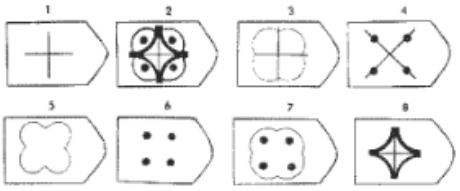
PROBLEMA 7



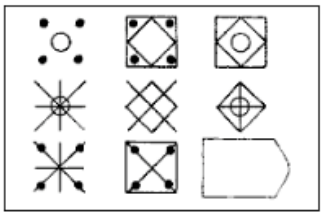


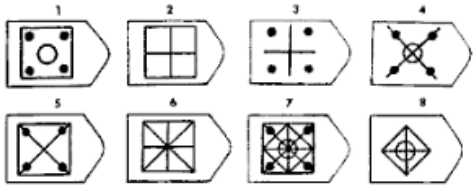
PROBLEMA 8





PROBLEMA 9





16.1. Quanti dei precedenti 9 problemi pensi di aver risolto correttamente? Inserisci un numero da 0 a 9.

16.2. Quanto sei sicuro/a della tua risposta? Indica un numero da 0 a 10 dove 1 significa “insicuro/a” e 10 significa “sicuro/a al 100%”.

16.3. Rispetto agli altri componenti della tua classe che hanno risposto alla stessa domanda, in che posizione pensi di essere nel caso si facesse una classifica (in cui il numero 1 corrisponde alla persona che ha correttamente risolto più problemi di tutto il resto dei partecipanti al questionario della tua classe)?

- Nella mia classe ci sono XX (numero da 0 a 40) ragazzi/e che stanno compilando il questionario, io penso di essermi classificato/a XX (numero da 1 a 40) nella domanda 16.

16.4. Quanto sei sicuro della precedente risposta? Indica un numero da 0 a 10 dove 1 significa “insicuro/a” e 10 significa “sicuro/a al 100%”.

Parte 3. In questa parte del questionario ti chiediamo di rispondere a una serie di domande relative alla tua attitudine verso il rischio, scegliendo una delle opzioni disponibili.

[Domande da Preference Survey Module: A Validated Instrument for Measuring Risk, Time, and Social Preferences (Falk et al. 2016)→ RISK TAKING]

17. Per favore, indica in generale, quanto sei disposto/a o non disposto/a a correre dei rischi, utilizzando una scala da 0 a 10, dove 0 significa che sei “assolutamente non disposto/a a correre rischi” e 10 significa che sei “completamente disposto/a a correre rischi”.
    Potrai utilizzare anche un qualsiasi numero tra 0 e 10 per indicare dove si trova il tuo punteggio nella scala, utilizzando 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.

17.1. LEGGERE: Per favore immagina la seguente situazione: Puoi scegliere tra un pagamento sicuro di una determinata somma di denaro, o una lotteria, dove hai la stessa probabilità di ottenere 150 Euro o nulla. Ti presenteremo 5 differenti situazioni.

17.1.1. Cosa preferiresti: una lotteria con il 50% di possibilità di ricevere 150 Euro, e la stessa possibilità al 50% di non ricevere nulla, o una somma di 80 Euro come pagamento sicuro?
- opportunità del 50% (Passare alla 17.1.17.)
- Pagamento sicuro (Continua)

17.1.2. Preferiresti la lotteria o una somma di 40 Euro come pagamento sicuro?
- opportunità del 50% (Passare alla 17.1.10.)
- Pagamento sicuro (Continua)

17.1.3. Preferiresti la lotteria o una somma di 20 Euro come pagamento sicuro?
- opportunità del 50% (Continua)
- Pagamento sicuro (Passare alla 17.1.7.)

17.1.4. Preferiresti la lotteria o una somma di 30 Euro come pagamento sicuro?
- opportunità del 50% (Continua)
- Pagamento sicuro (Passare alla 17.1.6.)

17.1.5. Preferiresti la lotteria o una somma di 35 Euro come pagamento sicuro?

- opportunità del 50% (Domanda su risk preferences terminata)
- Pagamento sicuro (Domanda su risk preferences terminata)

17.1.6. Preferiresti la lotteria o una somma di 25 Euro come pagamento sicuro?
- opportunità del 50% (Domanda su risk preferences terminata)
- Pagamento sicuro (Domanda su risk preferences terminata)

17.1.7. Preferiresti la lotteria o una somma di 10 Euro come pagamento sicuro?
- opportunità del 50% (Continua)
- Pagamento sicuro (Passare alla 17.1.9.)

17.1.8. Preferiresti la lotteria o una somma di 15 Euro come pagamento sicuro?
- opportunità del 50% (Domanda su risk preferences terminata)
- Pagamento sicuro (Domanda su risk preferences terminata)

17.1.9. Preferiresti la lotteria o una somma di 5 Euro come pagamento sicuro?
- opportunità del 50% (Domanda su risk preferences terminata)
- Pagamento sicuro (Domanda su risk preferences terminata)

17.1.10. Preferiresti la lotteria o una somma di 60 Euro come pagamento sicuro?
- opportunità del 50% (Passare alla 17.1.14)
- Pagamento sicuro (Continua)

17.1.11. Preferiresti la lotteria o una somma di 50 Euro come pagamento sicuro?
- opportunità del 50% (Passare alla 17.1.13.)
- Pagamento sicuro (Continua)

17.1.12. Preferiresti la lotteria o una somma di 45 Euro come pagamento sicuro?
- opportunità del 50% (Domanda su risk preferences terminata)
- Pagamento sicuro (Domanda su risk preferences terminata)

17.1.13. Preferiresti la lotteria o una somma di 55 Euro come pagamento sicuro?
- opportunità del 50% (Domanda su risk preferences terminata)
- Pagamento sicuro (Domanda su risk preferences terminata)

17.1.14. Preferiresti la lotteria o una somma di 70 Euro come pagamento sicuro?
- opportunità del 50% (Continua)
- Pagamento sicuro (Passare alla 17.1.16.)

17.1.15. Preferiresti la lotteria o una somma di 75 Euro come pagamento sicuro?
- opportunità del 50% (Domanda su risk preferences terminata)
- Pagamento sicuro (Domanda su risk preferences terminata)

17.1.16. Preferiresti la lotteria o una somma di 65 Euro come pagamento sicuro?
- opportunità del 50% (Domanda su risk preferences terminata)
- Pagamento sicuro (Domanda su risk preferences terminata)

17.1.17. Preferiresti la lotteria o una somma di 120 Euro come pagamento sicuro?
- opportunità del 50% (Passare alla 17.1.25.)
- Pagamento sicuro (Continua)

17.1.18. Preferiresti la lotteria o una somma di 100 Euro come pagamento sicuro?
- opportunità del 50% (Passare alla 17.1.22)
- Pagamento sicuro (Continua)

17.1.19. Preferiresti la lotteria o una somma di 90 Euro come pagamento sicuro?
- opportunità del 50% (Continua)
- Pagamento sicuro (Passare alla 17.1.21)

17.1.20. Preferiresti la lotteria o una somma di 95 Euro come pagamento sicuro?
- opportunità del 50% (Domanda su risk preferences terminata)
- Pagamento sicuro (Domanda su risk preferences terminata)

17.1.21. Preferiresti la lotteria o una somma di 85 Euro come pagamento sicuro?
- opportunità del 50% (Domanda su risk preferences terminata)
- Pagamento sicuro (Domanda su risk preferences terminata)

17.1.22. Preferiresti la lotteria o una somma di 110 Euro come pagamento sicuro?
- opportunità del 50% (Continua)
- Pagamento sicuro (Passare alla 17.1.24)

17.1.23. Preferiresti la lotteria o una somma di 115 Euro come pagamento sicuro?
- opportunità del 50% (Domanda su risk preferences terminata)
- Pagamento sicuro (Domanda su risk preferences terminata)

17.1.24. Preferiresti la lotteria o una somma di 105 Euro come pagamento sicuro?
- opportunità del 50% (Domanda su risk preferences terminata)
- Pagamento sicuro (Domanda su risk preferences terminata)

17.1.25. Preferiresti la lotteria o una somma di 140 Euro come pagamento sicuro?
- opportunità del 50% (Passare a 17.1.29)
- Pagamento sicuro (Continua)

17.1.26. Preferiresti la lotteria o una somma di 130 Euro come pagamento sicuro?
- opportunità del 50% (Continua)
- Pagamento sicuro (Passare a 17.1.28)

17.1.27. Preferiresti la lotteria o una somma di 135 Euro come pagamento sicuro?
- opportunità del 50% (Domanda su risk preferences terminata)
- Pagamento sicuro (Domanda su risk preferences terminata)

17.1.28. Preferiresti la lotteria o una somma di 125 Euro come pagamento sicuro?
- opportunità del 50% (Domanda su risk preferences terminata)
- Pagamento sicuro (Domanda su risk preferences terminata)

17.1.29. Preferiresti la lotteria o una somma di 150 Euro come pagamento sicuro?
- opportunità del 50% (Passare a 17.1.31)
- Pagamento sicuro (Continua)

17.1.30. Preferiresti la lotteria o una somma di 145 Euro come pagamento sicuro?
- opportunità del 50% (Domanda su risk preferences terminata)
- Pagamento sicuro (Domanda su risk preferences terminata)

17.1.31. Preferiresti la lotteria o una somma di 155 Euro come pagamento sicuro?
- opportunità del 50% (Domanda su risk preferences terminata)
- Pagamento sicuro (Domanda su risk preferences terminata)

Parte 4. In questa parte del questionario ti chiediamo di rispondere a una serie di domande relative alla tua attitudine verso il valore del denaro in diversi momenti nel tempo, scegliendo una delle opzioni disponibili.

[Domande da Preference Survey Module: A Validated Instrument for Measuring Risk, Time, and Social Preferences (Falk et al. 2016)→ TIME PREFERENCES]

18. Supponi che ti venga data la possibilità di scegliere tra i seguenti: ricevere un pagamento oggi o un pagamento tra 12 mesi. Ora ti presenteremo 5 situazioni. Il pagamento di oggi sarà lo stesso in ognuna di queste. Il pagamento in 12 mesi è differente in ciascuna situazione. Per ognuna delle seguenti situazioni vorremmo sapere quale sceglieresti. Per favore, presumi non ci sia nessuna inflazione, ovvero che i prezzi futuri siano gli stessi di oggi

18.1.1. Per favore prendi in considerazione la seguente opzione: Preferiresti ricevere 100 Euro oggi o 154 Euro tra 12 mesi?
- Oggi (Passare a 18.1.17)
- Tra 12 mesi (Continua)

18.1.2. Per favore prendi in considerazione la seguente opzione: Preferiresti ricevere 100 Euro oggi o 125 Euro tra 12 mesi?
- Oggi (Passare a 18.1.10)
- Tra 12 mesi (Continua)

18.1.3. Per favore prendi in considerazione la seguente opzione: Preferiresti ricevere 100 Euro oggi o 112 Euro tra 12 mesi?
- Oggi (Passare a 18.1.7)
- Tra 12 mesi (Continua)

18.1.4. Per favore prendi in considerazione la seguente opzione: Preferiresti ricevere 100 Euro oggi o 106 Euro tra 12 mesi?
- Oggi (Passare a 18.1.6.)
- Tra 12 mesi (Continua)

18.1.5. Per favore prendi in considerazione la seguente opzione: Preferiresti ricevere 100 Euro oggi o 103 Euro tra 12 mesi?
- Oggi (Domanda su time preferences terminata)
- Tra 12 mesi (Domanda su time preferences terminata)

18.1.6. Per favore prendi in considerazione la seguente opzione: Preferiresti ricevere 100 Euro oggi o 109 Euro tra 12 mesi?
- Oggi (Domanda su time preferences terminata)
- Tra 12 mesi (Domanda su time preferences terminata)

18.1.7. Per favore prendi in considerazione la seguente opzione: Preferiresti ricevere 100 Euro oggi o 119 Euro tra 12 mesi?
- Oggi (Continua)
- Tra 12 mesi (Passare a 18.1.9.)

18.1.8. Per favore prendi in considerazione la seguente opzione: Preferiresti ricevere 100 Euro oggi o 122 Euro tra 12 mesi?
- Oggi (Domanda su time preferences terminata)
- Tra 12 mesi (Domanda su time preferences terminata)

18.1.9. Per favore prendi in considerazione la seguente opzione: Preferiresti ricevere 100 Euro oggi o 116 Euro tra 12 mesi?
- Oggi (Domanda su time preferences terminata)
- Tra 12 mesi (Domanda su time preferences terminata)

18.1.10. Per favore prendi in considerazione la seguente opzione: Preferiresti ricevere 100 Euro oggi o 139 Euro tra 12 mesi?
- Oggi (Passare a 18.1.14.)
- Tra 12 mesi (Continua)

18.1.11. Per favore prendi in considerazione la seguente opzione: Preferiresti ricevere 100 Euro oggi o 132 Euro tra 12 mesi?
- Oggi (Passare a 18.1.13)
- Tra 12 mesi (Continua)

18.1.12. Per favore prendi in considerazione la seguente opzione: Preferiresti ricevere 100 Euro oggi o 129 Euro tra 12 mesi?
- Oggi (Domanda su time preferences terminata)
- Tra 12 mesi (Domanda su time preferences terminata)

18.1.13. Per favore prendi in considerazione la seguente opzione: Preferiresti ricevere 100 Euro oggi o 136 Euro tra 12 mesi?
- Oggi (Domanda su time preferences terminata)
- Tra 12 mesi (Domanda su time preferences terminata)

18.1.14. Per favore prendi in considerazione la seguente opzione: Preferiresti ricevere 100 Euro oggi o 146 Euro tra 12 mesi?
- Oggi (Passare a 18.1.16.)
- Tra 12 mesi (Continua)

18.1.15. Per favore prendi in considerazione la seguente opzione: Preferiresti ricevere 100 Euro oggi o 143 Euro tra 12 mesi?
- Oggi (Domanda su time preferences terminata)
- Tra 12 mesi (Domanda su time preferences terminata)

18.1.16. Per favore prendi in considerazione la seguente opzione: Preferiresti ricevere 100 Euro oggi o 150 Euro tra 12 mesi?
- Oggi (Domanda su time preferences terminata)
- Tra 12 mesi (Domanda su time preferences terminata)

18.1.17. Per favore prendi in considerazione la seguente opzione: Preferiresti ricevere 100 Euro oggi o 185 Euro tra 12 mesi?
- Oggi (Continua)
- Tra 12 mesi (Passare a 18.1.25.)

18.1.18. Per favore prendi in considerazione la seguente opzione: Preferiresti ricevere 100 Euro oggi o 202 Euro tra 12 mesi?
- Oggi (Passare a 18.1.22.)
- Tra 12 mesi (Continua)

18.1.19. Per favore prendi in considerazione la seguente opzione: Preferiresti ricevere 100 Euro oggi o 193 Euro tra 12 mesi?
- Oggi (Continua)
- Tra 12 mesi (Passare a 18.1.21.)

18.1.20. Per favore prendi in considerazione la seguente opzione: Preferiresti ricevere 100 Euro oggi o 197 Euro tra 12 mesi?
- Oggi (Domanda su time preferences terminata)
- Tra 12 mesi (Domanda su time preferences terminata)

18.1.21. Per favore prendi in considerazione la seguente opzione: Preferiresti ricevere 100 Euro oggi o 189 Euro tra 12 mesi?
- Oggi (Domanda su time preferences terminata)
- Tra 12 mesi (Domanda su time preferences terminata)

18.1.22. Per favore prendi in considerazione la seguente opzione: Preferiresti ricevere 100 Euro oggi o 210 Euro tra 12 mesi?
- Oggi (Continua)
- Tra 12 mesi (Passare a 18.1.24.)

18.1.23. Per favore prendi in considerazione la seguente opzione: Preferiresti ricevere 100 Euro oggi o 215 Euro tra 12 mesi?
- Oggi (Domanda su time preferences terminata)
- Tra 12 mesi (Domanda su time preferences terminata)

18.1.24. Per favore prendi in considerazione la seguente opzione: Preferiresti ricevere 100 Euro oggi o 206 Euro tra 12 mesi?
- Oggi (Domanda su time preferences terminata)
- Tra 12 mesi (Domanda su time preferences terminata)

18.1.25. Per favore prendi in considerazione la seguente opzione: Preferiresti ricevere 100 Euro oggi o 169 Euro tra 12 mesi?
- Oggi (Passare a 18.1.29.)
- Tra 12 mesi (Continua)

18.1.26. Per favore prendi in considerazione la seguente opzione: Preferiresti ricevere 100 Euro oggi o 161 Euro tra 12 mesi?
- Oggi (Passare a 18.1.28.)
- Tra 12 mesi (Continua)

18.1.27. Per favore prendi in considerazione la seguente opzione: Preferiresti ricevere 100 Euro oggi o 158 Euro tra 12 mesi?
- Oggi (Domanda su time preferences terminata)
- Tra 12 mesi (Domanda su time preferences terminata)

18.1.28. Per favore prendi in considerazione la seguente opzione: Preferiresti ricevere 100 Euro oggi o 165 Euro tra 12 mesi?
- Oggi (Domanda su time preferences terminata)
- Tra 12 mesi (Domanda su time preferences terminata)

18.1.29. Per favore prendi in considerazione la seguente opzione: Preferiresti ricevere 100 Euro oggi o 177 Euro tra 12 mesi?
- Oggi (Passare a 18.1.31)
- Tra 12 mesi (Continua)

18.1.30. Per favore prendi in considerazione la seguente opzione: Preferiresti ricevere 100 Euro oggi o 173 Euro tra 12 mesi?
- Oggi (Domanda su time preferences terminata)
- Tra 12 mesi (Domanda su time preferences terminata)

18.1.31. Per favore prendi in considerazione la seguente opzione: Preferiresti ricevere 100 Euro oggi o 181 Euro tra 12 mesi?
- Oggi (Domanda su time preferences terminata)
- Tra 12 mesi (Domanda su time preferences terminata)

Parte 5. In questa parte del questionario ti chiediamo di indicare quanto sei d'accordo con una serie di affermazioni.

[Scala dell'autostima di Rosenberg (1965)]

19. Quanto sei d'accordo con le seguenti affermazioni? Barra una sola casella per ogni riga. (Fortemente d'accordo, D'accordo, In disaccordo, Fortemente in disaccordo).

19.1. Penso di valere almeno quanto gli altri
19.2. Penso di avere un certo numero di qualità
19.3. Sono portato a pensare di essere un vero fallimento
19.4. Sono in grado di fare le cose bene almeno come la maggior parte delle persone
19.5. Penso di non avere molto di cui essere fiero
19.6. Ho un atteggiamento positivo verso me stesso
19.7. Complessivamente sono soddisfatto di me stesso
19.8. Desidererei avere maggior rispetto di me stesso
19.9. Senza dubbio a volte mi sento inutile
19.10. A volte penso di essere un buono a nulla

Parte 6. In questa parte del questionario ti chiediamo di indicare quanto sei d'accordo con una serie di affermazioni.

[Misura di Self-efficacy. Schwarzer and Jerusalem (1995)**]**

20. Quanto ritieni essere vere le seguenti affermazioni in riferimento a te stesso? Barra una sola casella per ogni riga. (Per nulla vero, Poco vero, Abbastanza vero, Totalmente vero).

20.1. Riesco sempre a risolvere problemi difficili se ci provo abbastanza seriamente
20.2. Se qualcuno mi contrasta, posso trovare il modo o il sistema di ottenere ciò che voglio
20.3. Per me è facile attenermi alle mie intenzioni e raggiungere i miei obiettivi
20.4. Ho fiducia di poter affrontare efficacemente eventi inattesi
20.5. Grazie alle mie risorse, so come gestire situazioni impreviste
20.6. Posso risolvere la maggior parte dei problemi se ci metto il necessario impegno
20.7. Rimango calmo nell'affrontare le difficoltà perchè posso confidare nelle mie capacità di fronteggiarle
20.8. Quando mi trovo di fronte ad un problema, di solito trovo parecchie soluzioni
20.9. Se sono in "panne", posso sempre pensare a qualcosa da mettere in atto
20.10. Non importa quello che mi può capitare, di solito sono in grado di gestirlo

Parte 7. In questa parte del questionario ti chiediamo di completare un'attività seguendo le istruzioni che appariranno sullo schermo.

21. **[Misura di attitudine alla competizione** (Harris and Houston, 2010)]

Quanto sei d'accordo con le seguenti affermazioni? Barra una sola casella per ogni riga. (Fortemente d'accordo, D'accordo, Nè in accordo né in disaccordo, In disaccordo, Fortemente in disaccordo). Non c'è una risposta giusta o sbagliata. Semplicemente rispondi onestamente rispetto a come ti senti di solito, senza spendere troppo tempo in ogni risposta.

21.1. Trovo soddisfazione dal competere con gli altri.
21.2. Sono una persona competitiva.
21.3. Farei qualsiasi cosa per evitare una discussione.
21.4. Cerco di evitare le discussioni.
21.5. Spesso rimango in silenzio piuttosto di rischiare di ferire un'altra persona.
21.6. Penso che le situazioni competitive siano poco piacevoli. Cerco di evitare di competere con gli altri.
21.7. In generale preferisco accodarmi al gruppo piuttosto che creare un conflitto.
21.8. Non mi piace competere con le altre persone.
21.9. Ho timore di competere con altre persone.
21.10. Mi piace competere con un avversario.
21.11. Cerco spesso di fare meglio degli altri.
21.12. Mi piace la competizione.
21.13. Non mi piace sfidare gli altri anche quando loro sono in torto.

Parte 8. In questa parte del questionario ti chiediamo di rispondere a delle domande relative alla tua carriera scolastica e alle attività a cui ti dedichi nel tempo libero.

[Misura di abilità cognitive]

22. **[solo per chi è iscritto dal 2° al 5° anno]** Puoi mettere in ordine di preferenza le seguenti materie? 1 indica la materia preferita maggiormente mentre 3 indica la materia meno preferita.
    - Lingua straniera:
    - Matematica:
    - Italiano:

23. **[solo per chi è iscritto dal 2° al 5° anno]** Puoi indicarci che voto hai avuto alla fine dello scorso anno nelle seguenti materie?
    - Lingua straniera:
    - Matematica:
    - Italiano:

24. **[solo per chi è iscritto dal 2° al 5° anno]** Puoi indicarci la media punti complessiva alla fine dello scorso anno? Inserisci un numero da 1 a 10 **[solo per chi è iscritto al 1° anno]** Puoi indicarci il giudizio che hai ottenuto alla fine dello scorso anno? Scegli una opzione tra sufficiente; buono; distinto; ottimo; eccellente.

[Misura di attività scolastiche ed extra-scolastiche]

25. Oltre allo studio delle materie scolastiche, svolgi delle altre attività nel tempo libero (es. pratichi sport, suoni uno strumento, svolgi attività di volontariato)? Per ognuna delle categorie qui sotto elencate, per favore indica anche l'intensità con cui pratichi queste attività.

    - Sport: (sì/no) → Se sì scegliere una opzione tra le seguenti (1 volta a settimana; 2 volte a settimana; 3 o più volte a settimana)
    - Musica: (sì/no) → Se sì scegliere una opzione tra le seguenti (1 volta a settimana; 2 volte a settimana; 3 o più volte a settimana)
    - Volontariato: (sì/no) → Se sì scegliere una opzione tra le seguenti (1 volta a settimana; 2 volte a settimana; 3 o più volte a settimana)
    - Altro: (sì/no) → Se sì scegliere una opzione tra le seguenti (1 volta a settimana; 2 volte a settimana; 3 o più volte a settimana)

26. **[solo per chi è iscritto dal 2° al 5° anno]** Negli scorsi anni, hai partecipato a una delle seguenti competizioni organizzate nella tua scuola?
    - Certamen (sì/no) → Se sì scegliere una opzione tra le seguenti (vi ho partecipato 1 volta finora; vi ho partecipato 2 volte finora; vi ho partecipato 3 o più volte finora;)
    - Olimpiadi di Matematica: (sì/no) → Se sì scegliere una opzione tra le seguenti (vi ho partecipato 1 volta finora; vi ho partecipato 2 volte finora; vi ho partecipato 3 o più volte finora;)

[Misura di aspirazioni]

27. Quando avrai finito il quinto anno di scuola superiore, vorresti poi proseguire il tuo percorso scolastico all'Università?

Sì/No/Non so ancora

28. [Nel caso si abbia risposto sì alla precedente domanda] Puoi indicarci quali sono le tre macro-aree disciplinari a livello universitario a cui ti piacerebbe iscriverti in ordine di preferenza? Il numero 1 indica la macro area disciplinare a cui preferiresti maggiormente iscriverti mentre il numero 4 indica la macro area disciplinare a cui preferiresti di meno iscriverti.
    - Area scienze sociali e umanistiche (ad esempio Psicologia, Letteratura, Lingue, Storia, Filosofia, Economia, etc.)
    - Area scientifico-tecnologica (ad esempio Ingegneria, Matematica, Fisica, Astronomia, Chimica, Informatica, etc.)
    - Area medica
    - Altro

Parte 9. In questa parte del questionario ti chiediamo di indicare quanto una serie di affermazioni ti descrivono bene.
[Misura di self-control (Tangney, Baumeister and Boone (2004)**]**

29. Per favore, utilizzando la scala allegata, indica quanto ognuna delle seguenti affermazioni riflette come sei normalmente (scala da 1 a 5 dove 1 indica assolutamente no e 5 indica Molto)

29.1. Sono bravo a resistere alle tentazioni
29.2. Trovo difficoltà a mollare le cattive abitudini.
29.3. Sono pigro.
29.4. Dico cose inappropriate.
29.5. Faccio cose che non mi fanno bene, se sono divertenti.
29.6. Rifiuto le cose che non mi fanno bene.
29.7. Vorrei avere maggiore auto-disciplina.
29.8. Gli altri direbbero che ho un'auto-disciplina di ferro.
29.9. Il piacere e il divertimento a volte mi impediscono di finire il lavoro che devo fare.
29.10. Ho difficoltà a concentrarmi.
29.11. Sono in grado di lavorare in modo efficace per raggiungere obiettivi distanti nel tempo.
29.12. A volte non riesco a impedirmi di fare delle cose, anche se so che sono sbagliate.
29.13. A volte agisco senza pensare a tutte le possibili alternative.

"Un'analisi delle aspettative, prospettive e obiettivi degli studenti"

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Gentile Signora/Signore,

Sua/o figlia/o è invitata/o a prendere parte ad uno studio condotto nel quadro del progetto di ricerca "*Un'analisi delle aspettative, prospettive e obiettivi degli studenti*" (il "Progetto") volto a esaminare le aspettative e prospettive degli studenti e le possibili condizioni che determinano la scelta dei percorsi di studio e di carriera futuri. Questo Progetto è svolto dalla Prof.ssa Valeria Maggian (Università Cà Foscari di Venezia) in collaborazione con la Prof.ssa Natalia Montinari (Università di Bologna) e il Prof. Antonio Nicolò (Università degli Studi di Padova). Prima di decidere se suo/a figlio/a possa partecipare, le chiediamo di leggere questo documento e di fare tutte le domande che ritiene opportune a chi le ha illustrato il Progetto.

1. Breve descrizione e Obiettivi

Il Progetto ha come obiettivo l'analisi delle aspettative degli studenti rispetto al proprio futuro e delle condizioni che ne possono determinare le scelte in ambito di percorso di studio o di scelta di carriera. La nostra analisi è volta a indagare come fattori non cognitivi, come aspettative, confidenza nei propri mezzi, aspirazioni, etc., possano avere un impatto sulle scelte dei ragazzi e delle ragazze sia in ambito scolastico che in ambito extra-scolastico. Per raggiungere questo obiettivo, i ricercatori impegnati nel Progetto si propongono di analizzare i dati raccolti tramite un questionario online che verrà sottoposto durante l'orario scolastico nella classe di suo/a figlio/a. La compilazione del questionario avrà una durata di circa un'ora e includerà domande di natura psicologica e sulle materie preferite da suo/a figlio/a. I ricercatori, ove suo/a figlio/a partecipi ad altri test svolti a scuola (per esempio, Olimpiadi della Fisica, Olimpiadi di Italiano, Olimpiadi della Matematica, Olimpiadi di Filosofia, etc.), raccoglieranno eventualmente il risultato ottenuto nelle prove.

2. Cosa comporta la partecipazione allo studio?

Per partecipare al Progetto non è necessaria alcuna preparazione specifica perché non vengono misurate le capacità o la preparazione dei partecipanti. La finalità è analizzare come la rilevanza di fattori non-cognitivi e di contesto influenzino le scelte degli studenti nelle attività scolastiche ed extra-scolastiche. I questionari saranno compilati on-line tramite un link che sarà fornito agli studenti utilizzando una piattaforma denominata Qualtrics. Il questionario sarà compilato dagli studenti tramite il proprio smartphone, se in sua disponibilità, oppure attraverso i pc a disposizione dell'istituto o altresì con dei tablet che i ricercatori forniranno ai ragazzi. Al termine dello studio

vostro/a figlio/a parteciperà all'estrazione di 100 buoni dal valore di 10 Euro da utilizzare presso le librerie Feltrinelli (o anche online) come ricompensa per la sua partecipazione allo studio.
Il questionario permetterà di raccogliere i dati in forma de-identificata (non saranno cioè raccolti i dati identificativi di suo/a figlio/a, ma solo la scuola di appartenenza, l'anno di corso, la sezione, il genere e la data di nascita) e, nel rispetto della privacy, saranno analizzati esclusivamente per scopi scientifici. Anche i risultati di altri test eventualmente svolti a scuola da suo figlio/a (Olimpiadi di Fisica, Olimpiadi di Italiano, Olimpiadi di Matematica, Olimpiadi di Filosofia, etc.) verranno raccolti in forma de-identificata (l'abbinamento con il questionario avverrà grazie all'indicazione della scuola, classe e data di nascita di suo/a figlio/a).

3. Benefici, disagi e/o rischi potenziali della partecipazione

La partecipazione al Progetto è volontaria e gratuita e non comporta nessun tipo di rischio o disagio per i partecipanti. Non ci sono incentivi di natura scolastica per la partecipazione, né eventuali ripercussioni in caso di mancata partecipazione. Le segnaliamo che l'unico beneficio diretto e prevedibile per la partecipazione a questo studio è la partecipazione all'estrazione di 100 buoni dal valore di 10 Euro da utilizzare presso le librerie Feltrinelli (o anche online).

4. Ritiro dallo studio

Lei ha il diritto di ritirare in qualsiasi momento il suo consenso alla partecipazione a questo Progetto, anche senza preavviso o motivazione specifica.

5. Misure previste per tutelare la riservatezza

Come detto, verranno raccolti solo informazioni de-identificati, cioè prive dei dati anagrafici o altri riferimenti che possano permettere di ricollegare direttamente singole scelte e affermazioni a una specifica persona. L'elaborazione dei dati sarà, quindi, condotta in modo da garantire la riservatezza dei partecipanti, nel rispetto della normativa sulla tutela dei dati personali. I risultati della ricerca saranno pubblicati in forma aggregata e in nessun caso saranno riconducibili a singole persone. Per maggiori informazioni, la preghiamo di leggere l'informativa sui dati personali di cui al paragrafo che segue.

6. Informativa sul trattamento dei dati personali

L'Università Ca' Foscari Venezia, nell'ambito delle proprie finalità istituzionali e in adempimento agli obblighi previsti dagli artt. 13 e 14 del Regolamento UE 2016/679 ("Regolamento"), Le fornisce informazioni in merito al trattamento dei dati personali raccolti nell'ambito del Progetto. In particolare, con la compilazione dell'autorizzazione alla partecipazione al Progetto da parte di suo/a figlio/a le verrà chiesto di inserire i seguenti dati personali: dati anagrafici suoi e di suo/a figlio/a nonché l'indirizzo di residenza di famiglia. Inoltre, con la compilazione del questionario, suo/a figlio/a ci comunicherà, in forma de-identificata (senza cioè indicare i suoi dati anagrafici), le seguenti informazioni: genere, nazionalità, data di nascita, dati relativi al percorso scolastico (scuola, anno di corso, sezione), dati relativi alla composizione del nucleo familiare (numero di fratelli, genere e loro età), dati relativi al percorso di studio e professione dei genitori, loro nazionalità, lingua parlata a casa, nonché

dati relativi alle abilità non cognitive (test). Infine, verrà eventualmente acquisito l'esito di altri test svolti a scuola da suo figlio/a (per esempio, Olimpiadi della Fisica, Olimpiadi di Italiano, Olimpiadi della Matematica, Olimpiadi di Filosofia, etc.).

Il Progetto è svolto in collaborazione con l'Università di Bologna e l'Università degli Studi di Padova.

Il Titolare del trattamento è l'Università Ca' Foscari Venezia, con sede in Dorsoduro n. 3246, 30123 Venezia (VE), nella persona del Magnifico Rettore.

L'Università ha nominato il "Responsabile della Protezione dei Dati", che può essere contattato scrivendo all'indirizzo di posta elettronica dpo@unive.it o al seguente indirizzo: Università Ca' Foscari Venezia, Responsabile della Protezione dei Dati, Dorsoduro n. 3246, 30123 Venezia (VE).

Il Progetto è svolto nell'ambito delle attività istituzionali dell'Università: pertanto, la base giuridica di tale trattamento è rappresentata dall'art. 6.1.e) del Regolamento (esecuzione di un compito d'interesse pubblico).

Il trattamento dei dati personali è improntato ai principi di correttezza, liceità e trasparenza e di tutela della riservatezza e dei diritti dell'interessato, nonché agli ulteriori principi previsti dall'art. 5 del Regolamento.

I dati verranno conservati per 10 anni successivi alla conclusione del Progetto.

I dati conferiti saranno accessibili ai ricercatori coinvolti nel Progetto e a eventuali auditor. Inoltre, l'Università si serve di soggetti terzi che forniscono servizi strumentali ed accessori alla stessa, che sono stati nominati Responsabili del Trattamento (ad es. Qualtrics per la somministrazione dei questionari).

I risultati del Progetto saranno divulgati in forma aggregata mediante pubblicazione di articoli scientifici, libri, e, più in generale, di materiale scientifico nonché nell'ambito di eventi di natura accademica e scientifica.

In qualità d'interessato, ha diritto di ottenere dall'Università, nei casi previsti dal Regolamento, l'accesso ai dati personali, la rettifica, l'integrazione, la cancellazione degli stessi o la limitazione del trattamento ovvero di opporsi al trattamento medesimo (artt. 15 e ss. del Regolamento). La richiesta potrà essere presentata, senza alcuna formalità, contattando direttamente il Responsabile della Protezione dei Dati all'indirizzo dpo@unive.it ovvero inviando una comunicazione al seguente recapito: Università Ca' Foscari Venezia - Responsabile della Protezione dei Dati, Dorsoduro 3246, 30123 Venezia. In alternativa, è possibile contattare il Titolare del trattamento, inviando una PEC a protocollo@pec.unive.it.

Gli interessati, che ritengono che il trattamento dei dati personali a loro riferiti avvenga in violazione di quanto previsto dal Regolamento, hanno, inoltre, il diritto di proporre reclamo all'Autorità Garante per la protezione dei dati personali, come previsto dall'art. 77 del Regolamento stesso, o di adire le opportune sedi giudiziarie (art. 79 del Regolamento).

7. Contatti

Per qualsiasi informazione e chiarimento su questo studio o per qualsiasi necessità può, inoltre, rivolgersi alla Prof.ssa Valeria Maggian (e-mail: valeria.maggian@unive.it).

Consenso informato alla partecipazione allo studio

Il/la sottoscritto/a _____

residente in _____, via _____

genitore di _____ (Nome e Cognome del ragazzo/a)

DICHIARA

• di aver letto il suddetto foglio informativo ricevuto, di aver compreso sia le informazioni in esso contenute sia le informazioni eventualmente fornite in forma orale dal personale addetto al Progetto di ricerca "Un'analisi delle aspettative, prospettive e obiettivi degli studenti" e di aver avuto ampio tempo ed opportunità di porre domande ed ottenere risposte soddisfacenti dal personale addetto;

• di aver compreso che la partecipazione al Progetto è del tutto volontaria e libera, che ci si potrà ritirare dallo stesso in qualsiasi momento, senza dover dare spiegazioni e senza che ciò comporti alcuno svantaggio o pregiudizio;

• di aver compreso la natura e le attività che la partecipazione al Progetto comportano e i relativi rischi;

• di aver compreso che la partecipazione a questo Progetto non comporterà il riconoscimento di alcun vantaggio di natura economica o scolastica diretto o indiretto.

Conseguentemente, il/la sottoscritto/a

☐ ACCONSENTE ☐ NON ACCONSENTE

A che sua/o figlia/o partecipi al Progetto, nella consapevolezza che tale consenso è manifestato liberamente ed è revocabile in ogni momento senza che ciò comporti alcuno svantaggio o pregiudizio.

_____, _____

(luogo e data)

_____

(firma di chi esercita la responsabilità genitoriale)

_____

(firma di chi raccoglie il consenso)